



Manhood Wildlife and Heritage Group



Fixing and Linking Our Wetlands (FLOW) Project

Earnley Parish

Ditch condition assessments results and prioritised drainage and habitat improvement plan

Jane Reeve and Christopher Drake

Manhood Wildlife and Heritage Group

February 2018



Medmerry realignment, Earnley Parish
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Fixing and Linking Our Wetlands
Earnley Parish ditch condition assessment results and habitat improvement plan

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Acronyms and abbreviations

Name	Acronym
Area of Outstanding Natural Beauty	AONB
Birdham & Earnley Flood Prevention Group	BEFPG
Cabinet Office Briefing Room	COBR
Chichester District Council	CDC
Chichester Harbour Conservancy	CHC
Department for Environment, Food & Rural Affairs	DEFRA
Environment Agency	EA
Fixing and Linking our Wetlands	FLOW
Geographical Information System	GIS
Heritage Lottery Fund	HLF
Manhood Peninsula	MP
Manhood Peninsula Partnership	MPP
Manhood Peninsula Surface Water Management Plan	MPSWMP
Manhood Wildlife and Heritage Group	MWHG
Natural England	NE
Operation Watershed	OW
Sussex Biodiversity Records Centre	SxBRC
Trust for Conservation Volunteer	TCV
West Sussex County Council	WSCC



Fixing and Linking Our Wetlands



Earnley Parish ditch condition assessment results and habitat improvement plan

Executive Summary

The Heritage Lottery Fund (HLF) Fixing and Linking Our Wetlands (FLOW) study of the Earnley Parish ditch system took eight months to complete and used a scoring system to analyse the main attributes of the ditches. This included drainage, environmental and biodiversity aspects. In this time 170 ditches and waterways were surveyed which totalled approximately 30 kilometres and this is illustrated in Figure 5.

Where they were associated with a ditch, 9 kilometres of hedgerows were also surveyed, and ash tree locations noted.

The majority of the ditches were found to be in good or moderate condition and it was clear that the main landowners do manage the ditches on their land. Most have a system of rotational management and these ditches tended to have the better vegetation structure and diversity.

Opportunities were found for improvements in the water storage capacity of ditch systems during high rainfall events that would also provide better wetland habitat. Other locations were found for pond enhancements that could provide better water storage. Putting small interventions like this into the system could make a difference during high rainfall events by just holding back a low percentage of the water.

Five opportunities for drainage improvements can be seen in Figure 17 and three opportunities for environmental improvements, in Figure 18, which range from improving vegetation diversity to hedge laying and opening up old ponds.

Feedback has been provided to all the landowners about the survey findings on their land with advice and ideas for improvements if needed.

The Earnley Parish has a ditch system that has been well looked after by its landowners. The parish drainage has been improved by the new Medmerry realignment scheme which has included new water tanking areas, wider flood alleviation channels and a better understanding of the rifes.

The Parish Flood Group have been very active in identifying and addressing areas of flooding, but the FLOW team did find some small opportunities to make drainage and environmental improvements. In the long term these could become attractive assets to the parish and be monitored and maintained by landowners and the community.

Contents

Section	Title	Page
1.	Introduction to the FLOW project	6
2.	The Heritage Lottery Fund Grant	9
3.	Earnley Parish	10
4.	Methodology	12
i	Access and initial information	12
ii	Ditch and pond surveys	12
iii	Hedge surveys	12
iv	CDC Green Infrastructure Maps	13
v	Ash Tree (<i>Fraxinus excelsior</i>) census	13
5.	Sources of information	14
6.	Results	15
i	Overall results of ditches surveyed	16
ii	Landowners	17
iii	Landowner reports	18
iv	Condition of the ditches across the parish	18
v	Hedges surveyed across the parish	19
vi	Ash tree census	20
7.	Discussion	21
i	Earnley's key waterways	21
ii	Overall condition of the ditches	23
iii	Management for water voles	26
iv	Limitations of the study	27
8.	Opportunities for improvement works	28
i	The opportunities	29
ii	High level physical works	33
iii	Low level physical and maintenance work	33
9.	Other environmental issues found	34
i	Water quality	34
ii	Litter	35
iii	Hedges	35
iv	Green network maps	37
10.	Timescales	38
11	Management priorities	39
12.	Sources of future help	40
i	Funding - grants	40
ii	Labour – volunteer led work	40

Section	Title	Page
13.	References	42
14.	Appendices	43
i	Ditch Condition Assessment Sheet (developed by the MWHG)	43
ii	Hedge Assessment Sheet (from the Sussex Biodiversity Records Centre)	45
iii	Costed Action Plan	46
iv	Example photos of findings	48

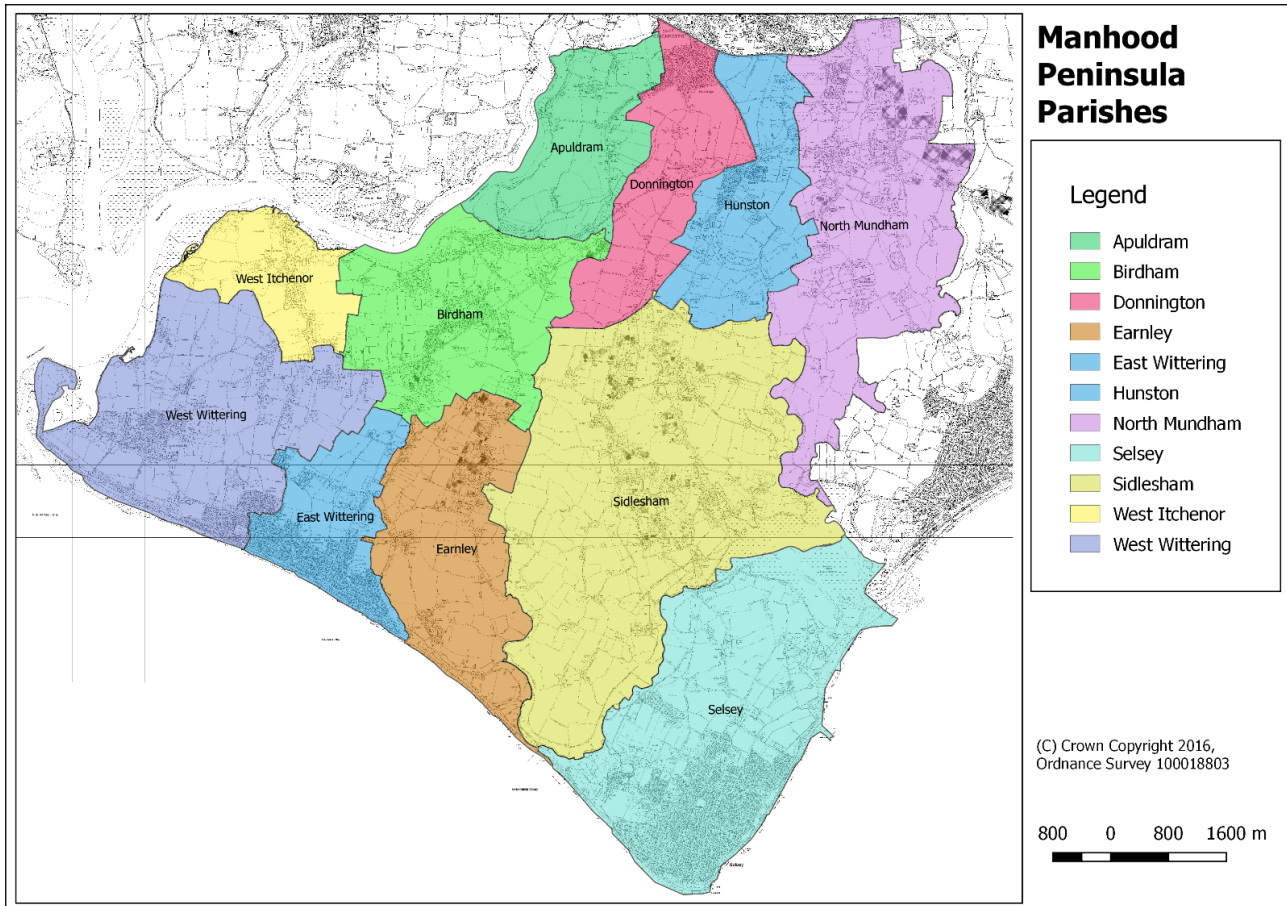
List of Figures

Figure	Title	Page
1	FLOW Project Area	6
2	Earnley Parish boundary	10
3	Drainage improvements in Earnley	11
4	CDC Green Networks map	13
5	Surveyed and unsurveyed ditches in Earnley	15
6	Landowners involved in the FLOW project in Earnley	17
7	Condition Assessment of ditches in Earnley Parish	18
8	Surveyed Hedgerows in Earnley	19
9	Ash tree census for Earnley	20
10	Drainage system of Earnley	22
11	The flow direction in Earnley Parish ditches	23
12	Rotational Management of ditch banks in Earnley	24
13	Diversity of vegetation types on ditch banks in Earnley	25
14	Water availability in ditches surveyed in Earnley	26
15	Approximate measure of the capacity of ditches surveyed in Earnley	28
16	Sediment depth in ditches surveyed in Earnley	29
17	Drainage opportunities identified in Earnley	30
18	Environmental opportunities identified in Earnley	32
19	Ditches containing litter in Earnley	35
20	Hedgerow improvement opportunities in Earnley	36
21	CDC Green network survey results for Earnley	37

1. Introduction to the FLOW Project

Fixing and Linking Our Wetlands, FLOW, is an HLF Project to carry out a complete condition assessment of all the wetlands on the Manhood Peninsula (MP), conduct hedgerow surveys of all the Parishes, and develop costed management plans to help identify and prioritise improvement.

Figure 1: FLOW Project area



Ditches and waterways form a large linked habitat on the MP, that connect the internationally important sites of Pagham Harbour, Medmerry and Chichester Harbour, and their care and upkeep is not just of benefit to wildlife but increasingly to local communities, as more frequent flooding events take place. Well maintained ditches, ponds and rifes allow water to be stored or flow away to the sea, reducing the risk of flooding and providing a stable and important home to many species, including the fast-declining water vole (Strachan 2011).

Repeated flooding events in 2012, 2013 and 2014 highlighted the need to address the condition of the wetland system. Responsibility now rests with riparian owners who may require encouragement, information and support to identify and tackle what needs doing. The dissolution of the local Internal Drainage Boards (IDBs) and Districts (IDDs) by DEFRA means that they are stepping back from much of the management of ditches and waterways that they have traditionally carried out and, again, riparian owners will have to take over.

WSCC published the Manhood Peninsula Surface Water Management Plan (MPSWMP) in July 2015, written by CHM2Hill consultants. They have stated that 'Given the scale and length of the drainage network in the

Manhood Peninsula, it is not possible or practicable for a single body to ensure that every part of the drainage system is fully functioning. There is simply insufficient resource and funding available for this to happen'. The role of the FLOW team is to have an overview of the parishes and to work with and advise different riparian owners, small and large about wetland management while also working with the diverse range of agencies that also have an interest in this area.

The MPSWMP recommendations support the work that FLOW intend to carry out by engaging the local community, advising riparian owners, identifying areas for improvement and managing that work. The recommendations were as follows:

'In the longer term ongoing management and maintenance will be critical to manage flooding. The MPSWMP identified five principles which are considered the fundamental elements to ensuring continued long-term maintenance and management of the drainage system across the Manhood Peninsula:

- + ditch clearance remains the responsibility of riparian owners and landowners;*
- + local communities have a key role to play;*
- + runoff into the ditch network needs to be controlled;*
- + the continuity of the ditch network is critical, and;*
- + a consequence-based approach should be adopted (i.e. focusses on the critical parts of the drainage network).*

The ongoing management and investment should be based around four key themes:

- + the importance of land drainage consents to prevent culverting or infilling of watercourses where it will increase flood risk;*
- + the need to control runoff from new developments;*
- + the requirement to continue maintaining watercourses, culverts and highway drainage on a cyclical basis, and;*
- + the need to control runoff from glass houses on the Manhood Peninsula.*

The objective is to ensure that the drainage system is managed and maintained on a proactive, cyclical basis to ensure it is functioning as intended. This can be achieved through an annual walkover survey of the critical drainage routes to identify their condition, maintenance requirements and any land drainage consent issues. This should take place in late autumn to allow vegetation die back following the summer, but also to identify any remedial measures before the wet winter months when the Manhood Peninsula is primarily affected by flooding'

Hedges are another important habitat as they are abundant but undermanaged and overlooked on the MP, often originally relic pieces of woodland, they act as important green infrastructure. The hedges in this area are often associated with a drainage ditch and these form the boundaries to fields. The two combined offer good wildlife corridors and connect the designated areas of Pagham and Chichester Harbours, and Medmerry. Hedgerows, whether related to ditches or not, can be targeted for improvement to combat soil erosion and reduce surface water movement across agricultural land which is an important factor in overall water management.

MWHG have received funding from the HLF to carry out the FLOW Project. The project aims to gain a working understanding of the ditch network across the peninsula by assessing the condition of the ditches which form



Fixing and Linking Our Wetlands Earnley Parish ditch condition assessment results and habitat improvement plan

it. An action plan of suggested improvement work will be produced, focusing on reducing the impact of flooding and enhancing biodiversity. Some of the work outlined may be carried out as part of the FLOW project. In addition to the main focus on the wetland network, the project will look at other important habitats across the peninsula including hedgerows and rough grassland. These will inform Chichester District Council (CDC) Green Infrastructure maps which investigate habitat provision and connectivity specifically for water voles, bats and barn owls.

Much of the area has been neglected and this will continue unless the issues arising in the wider environment between the managed sites are addressed. The area offers a discrete opportunity for demonstrating the importance of the Lawton Report (2010) suggestions and thus would contribute to enhancing not only the habitats and their associated species but would increase resilience in the face of climate change and provide an example for others to follow.



Fixing and Linking Our Wetlands



Earnley Parish ditch condition assessment results and habitat improvement plan

2. The Heritage Lottery Fund Grant

The Heritage Lottery Grant for the Fixing and Linking Our Wetlands Project (FLOW) (HG-14-06996) was awarded in June 2015 to the Manhood Wildlife and Heritage Group to carry out the Development Phase from September 2015. This lasted until 31st May 2016 and the time was spent on a Pilot study area, West Wittering, developing and refining the projects aims, objectives and activities, reviewing the budget and understanding which outputs would be useful.

In October 2016, the MWHG were awarded a grant from the HLF to continue the project until March 2021 and therefore the ditches and hedges in the remaining parishes be surveyed and mapped with a view to improvement. This will cover the parishes of Apuldram, Donnington, Earnley, Hunston, North Mundham, Selsey and Sidlesham *, and allow a comprehensive picture of the condition of the waterways, and potential improvements, to be seen.

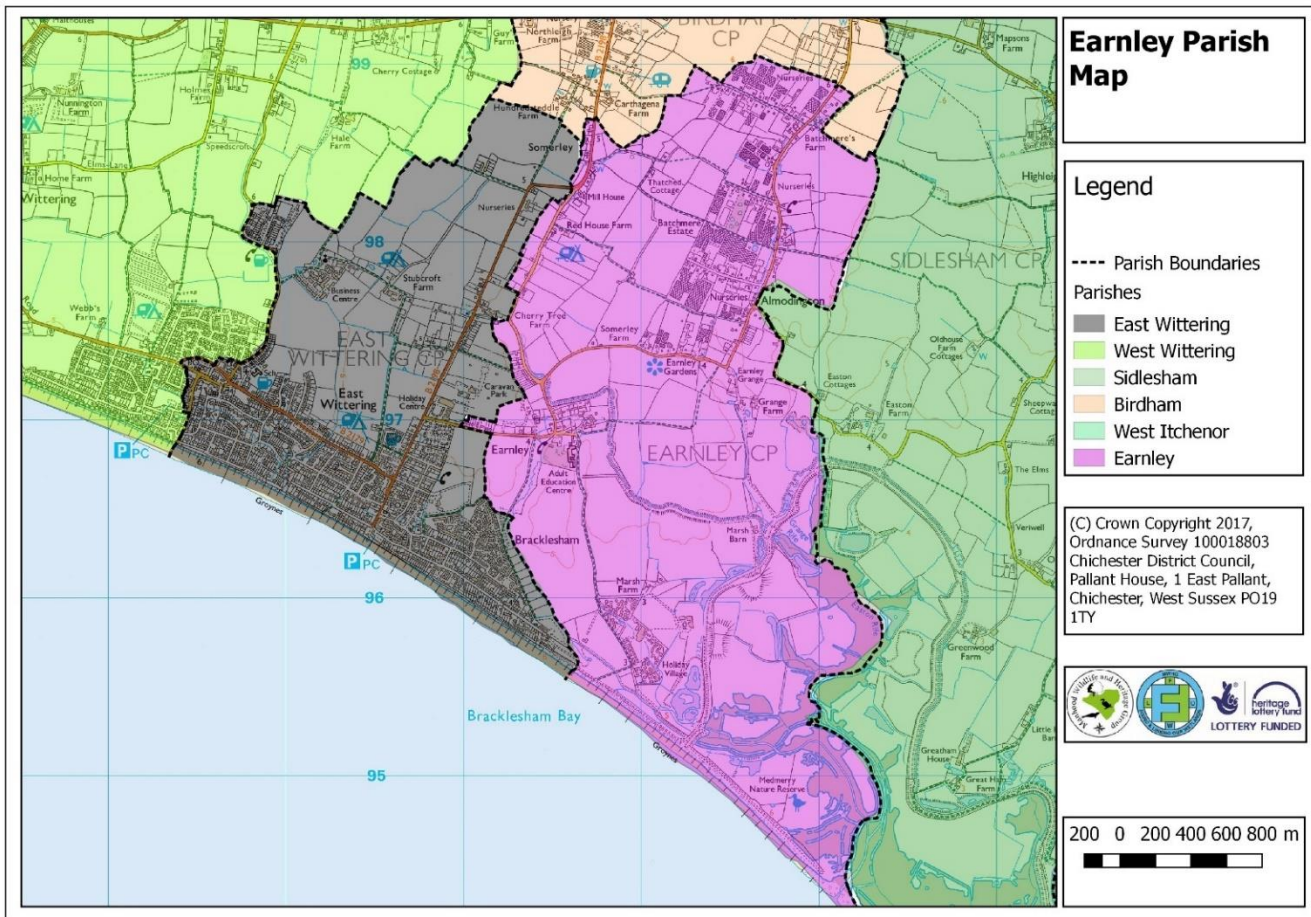
While the parishes of West Itchenor and Birdham are not being surveyed, they are being included in wetland improvement works and projects being supported by volunteers and consultancy input by FLOW staff.

* Birdham and West Itchenor parishes were previously surveyed in 2013 and 2014 as part of an independently funded wetlands project.

3. Earnley Parish

Earnley is the third parish to be surveyed as part of the FLOW survey schedule and the fifth to be surveyed since 2014 when grants from CHC, CDC and MPP funded ditch assessment projects in the parishes of Birdham and West Itchenor, following significant flooding in previous years.

Figure 2: Earnley Parish boundary



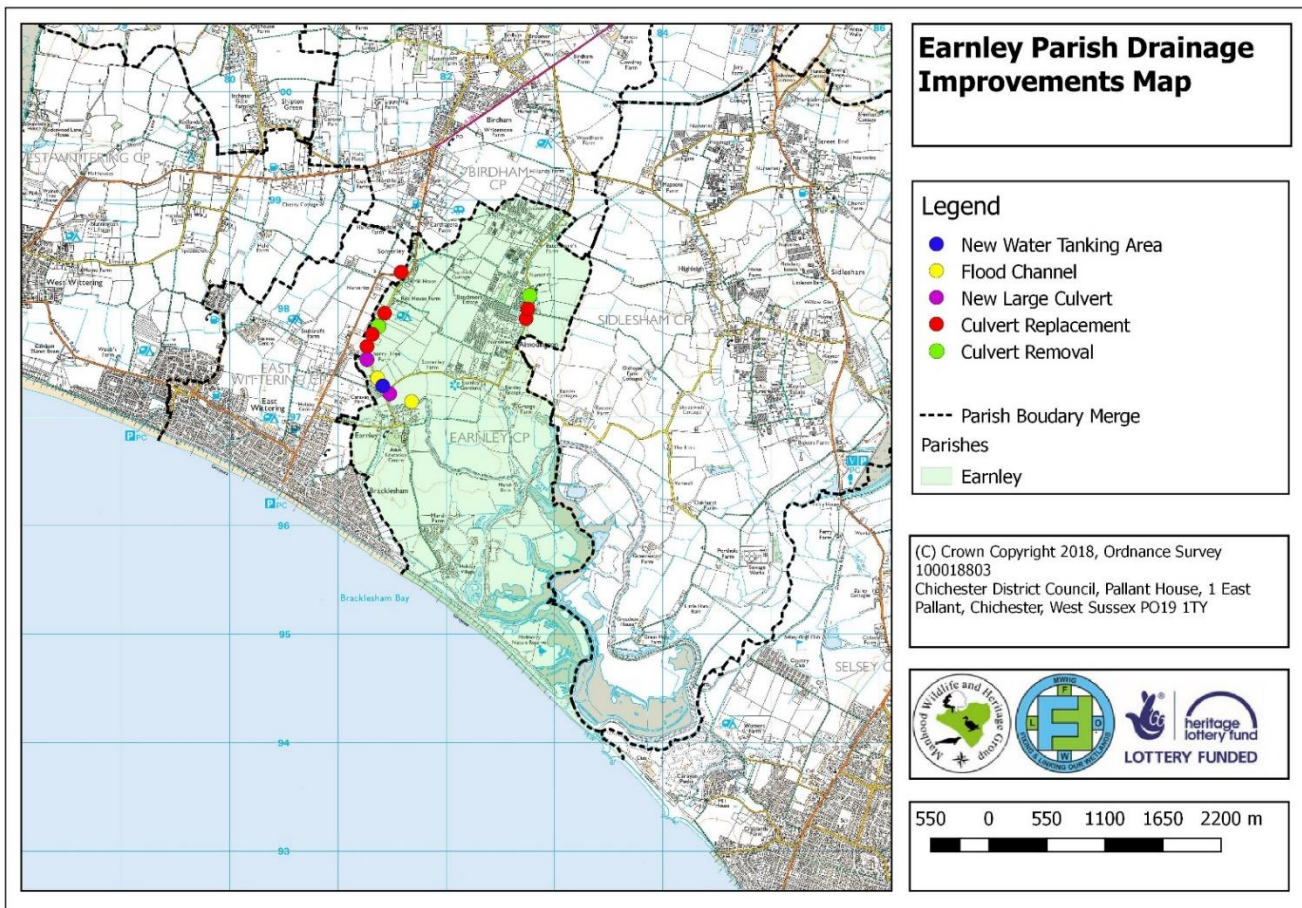
Earnley Parish is made up of four communities; Almodington, Batchmere, Earnley and Somerley, and sits between the parishes of Sidlesham and East Wittering and Bracklesham. The land is flat and predominately supports intensive arable farming and glasshouses for commercial production of plants and fruit. There are also tourism interests in the area and Earnley has a couple of low level camping/caravan businesses on farms and small holdings, and a chalet style holiday village near to the sea.

The Medmerry Managed Realignment Scheme covers part of the Earnley Parish and was completed by the EA in November 2013. It involved building new defences inland from the coast and allowing a new intertidal area to form seaward of the new defences. This created 7km of new inland sea wall and better long-term defences that would lower flood risk from the sea. It also created a new large intertidal area that is now being managed by the RSPB as a new reserve and which is already being colonized by a large range of wildlife species.

Despite being a fairly small parish, approximately 7.10km², there are 6 main rivers (rifes) running through it and they all carry water from farm drainage ditches that create a web across the land to the sea. These rifes now terminate at the Medmerry realignment scheme and water passes under the new sea wall via flaps and valves into the new intertidal area. As part of the development of the scheme, large water storage and holding areas were created on the land side of the sea wall to tank the water from the rifes during high tide when the water could not escape. These large pond/wetland areas tank water during high rainfall events allowing the rifes to continue to drain water away from the parish's roads and properties.

In 2012 and 2013 Earnley Parish suffered from severe flooding events and in Bookers Lane 11 properties were completely flooded, and 11 more in the Somerley area, to the north of the parish. The local Flood Group have been extremely active in investigating and remedying the causes of this flooding and have had local residents' investment, Earnley Parish Council, EA, WSCC (through Operation Watershed and Highways) funding to create a new flood channel that runs from Bookers Lane to the Medmerry realignment scheme. Culverts were also upsized and removed from this rife to prevent water overtopping onto the road and the capacity of this waterway has been greatly increased. In the Almodington area of the parish there have been many investigations of the rife there and culverts have been jetted, removed and upsized. There is currently a scheme being explored by the EA and flood group to put in a diversion scheme to take water, when the rife is running high, away, through farm ditches to Medmerry.

Figure 3: Drainage improvement work in Earnley Parish



4. Methodology

i. Access and initial information

Following contact with the Chair of the BEFPG, a meeting was held to confirm land ownership and access of land in Earnley. In addition, information was sought about the parish drainage and any associated issues. The Chair of the BEFPG was able to provide comprehensive information, the result of all his flood group work, about the landowners, the rifes, flooding issues, current flood reduction schemes and contact details. He also contacted all the landowners and asked them to cooperate with the project, which gave us an enormous head start.

ii. Ditch and pond surveys

A Ditch Condition Assessment sheet (Appendix I, section 14) was developed to capture a wide range of information on the ditches and ponds surveyed. These surveys have been designed to give a rapid assessment of a wide range of information including the physical attributes of each ditch (bank profile, water availability, storage capacity, conveyance potential etc), the emergent and bankside vegetation structure, historical and current management observations and surrounding land use. In addition, information on flow regimes and direction were recorded along with any additional information relevant to each survey site and a detailed sketch was completed. No survey was undertaken without landowner permission, which was granted by all those approached as part of this parish evaluation. All surveys were undertaken between March and November 2017.

The information gathered was 'scored' to enable comparisons between ditches. In order to produce maps of the results a traffic light system was developed with red as "poor", amber as "moderate" and green as "good". However, it should be noted that this scoring system is relative and as such does not imply an overall status but rather the specific ditch's condition relative to others surveyed.

Whilst the long-term intention of the FLOW project is to train volunteers from each Parish to undertake much of the survey work, and long-term management of improved areas, no local residents were successfully engaged to get involved at this stage of the project. Experienced and trained volunteers from MWHG undertook all survey work.

All data was compiled into Microsoft Excel Spreadsheets before being used to create maps of the parish using Geographical Information System (GIS), specifically, QGIS (Wein 2.14.13. 2017).

iii Hedge surveys

The FLOW project used a shorter hedgerow survey form provided by the Sussex Biodiversity Records Centre, adapted to identify potential dormice habitat (SxBRC), to create a summary that documents the tree species within the hedge along with its overall structure and shape and the surrounding land use. This hedge survey form was completed when carrying out ditch surveys with the priority to do a hedge survey where they were associated with ditches. Other hedges were captured where it was easy to do so.

The information collected will be sent to SxBRC to be added to the regional database. In addition, locations of hedge surveys have been mapped using QGIS and opportunities to in-fill gaps, create new hedgerows or implement sensitive hedgerow management have been identified.

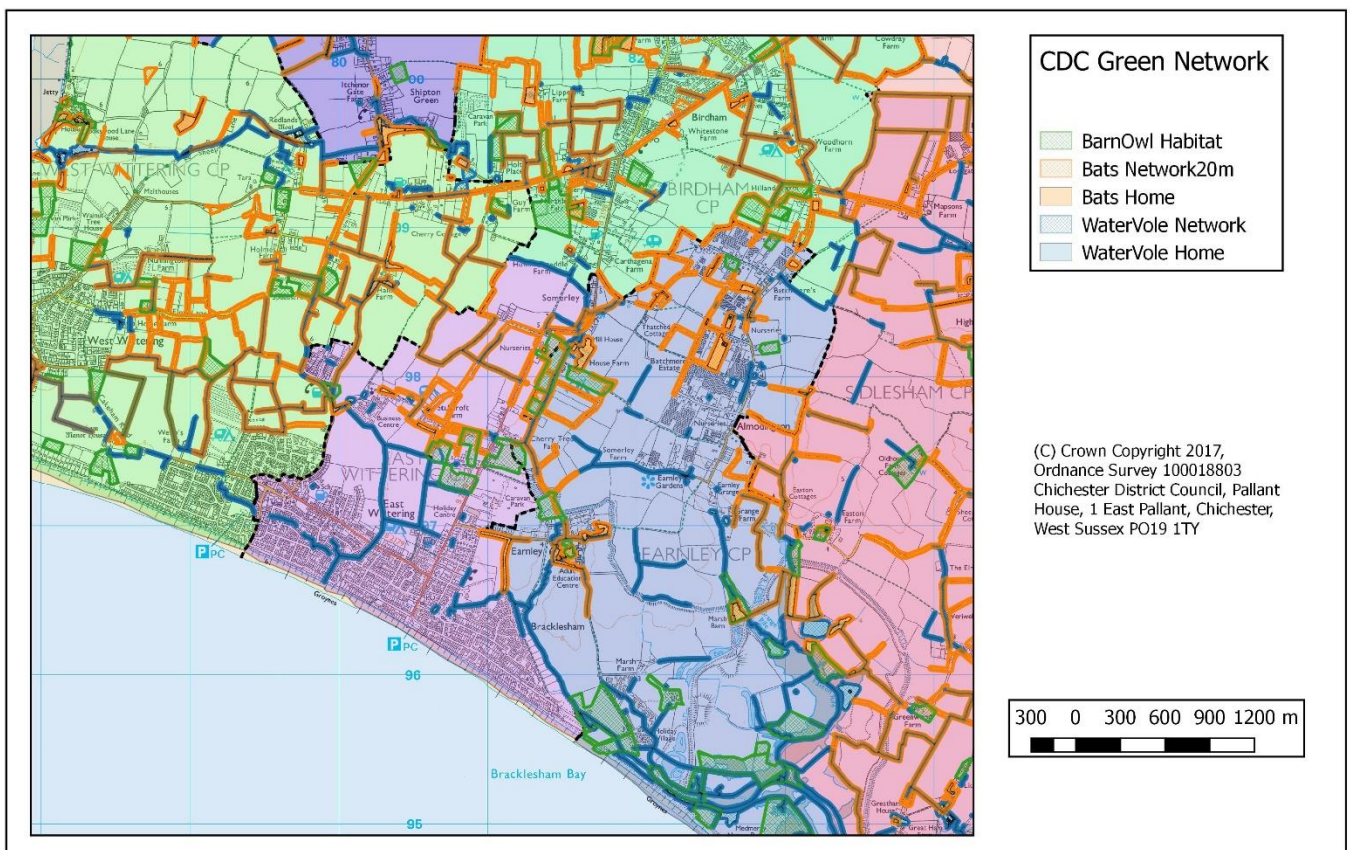
iv CDC Green Infrastructure maps

In 2013 CDC carried out a desk-based study mapping three key habitats on the MP. Data was used from the SxBRC, ecological surveys submitted through Planning applications and enquiries, local Biodiversity Action Plans and any other information that could be used. The data focussed on the waterways network with water voles (*Arvicola amphibius*) in mind, the hedges network for bats and rough grassland habitat for barn owls (*Tyto alba*).

As part of this Parish Survey we have ground-truthed these maps to give an indication of their accuracy for habitat associated with the target species.

Figure 3 shows the three different habitats marked up as green networks and these were examined during the fieldwork.

Figure 4: CDC Green Networks map



v. Ash tree (*Fraxinus excelsior*) census

At the request of the Tree Council, who were asked by the Cabinet Office Briefing Room (COBR), the presence of Ash trees on the MP have been recorded as this is currently the only area of the UK not to have a confirmed report of Ash Tree dieback. Ash tree locations were recorded on a hand held Global Positioning System (GPS) and mapped using QGIS (a free and open source Geographical Information System). This information will be passed to the Tree Council as a Geographical Information System (GIS) layer and a MS Excel spreadsheet.



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Earnley Parish ditch condition assessment results and habitat improvement plan

5. Sources of information

Information on drainage, the environment and flooding within the parish of Earnley has been gained locally from the Parish Council and landowners as well as Chichester District and West Sussex County Councils and the Environment Agency. The main source of important local information was the Birdham and Earnley Flood Prevention Group who provided landowner details.

Chichester District Council provided an Ordnance Survey License to enable mapping of results along with a number of local, relevant GIS layers. West Sussex Highways Authority granted access to GIS information regarding the local area (utility locations, agricultural land grading information, hedgerow information and other historical information) and allowed these to be printed. Further GIS based information has been obtained from the Open Access, Environment Agency website. NE data sets were also used to look at designated area boundaries, key species locations, habitat mapping and which farms are in stewardship.

Parish Tithe Maps were purchased from WSCC Records Office to inform on the historical location of features which could be reinstated or improved and the WSCC Manhood Peninsula Surface Water Management Plan (MPSWMP 2015), provided information about the flooding and drainage problems of Earnley. This has informed us of specific issues within the parish and enabled us to look more closely at and in those areas.

The individual landowners that we approached about access to their land were asked about detailed information on their ditches, the flow direction, historic and recent management, capacity, etc. Where possible we asked them to give us field maps with ditches marked on and to have a tour with them of their land.

6. Results

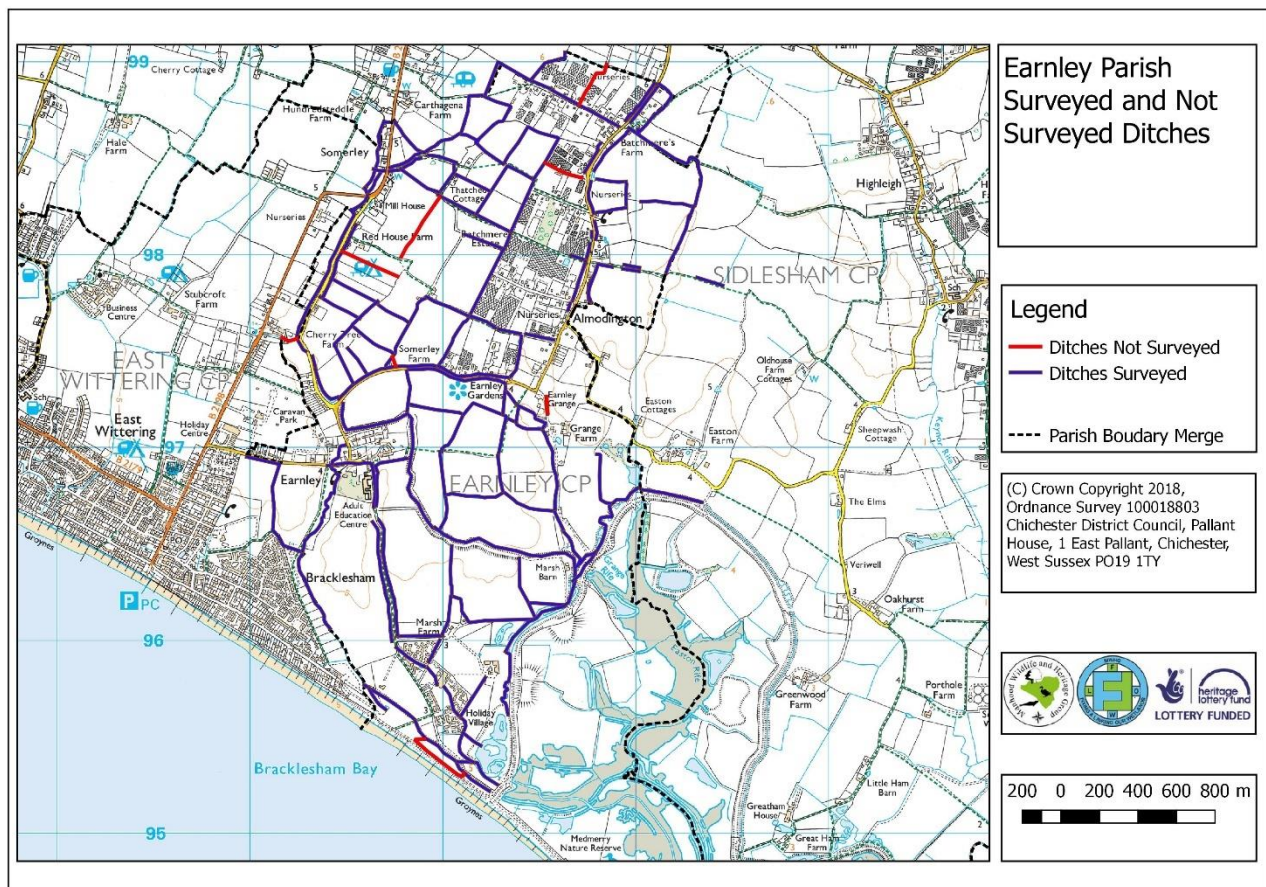
With the help of the Chair of the Flood Group and the landowners, we managed to survey most of the sites that we sought permission for, getting good coverage of Earnley Parish. One landowner was recently deceased, and his land was being managed by solicitors. They did not respond to frequent requests for access and so only the ditches that could be viewed from public access footpaths were surveyed. One landowner denied us access to his land, a very small plot, and the ditch on it, again, could be surveyed via a footpath with public access.

Where a landowner gave us permission to access their land and to carry out surveys, we tried to get complete coverage of that area, without concern for the parish boundary. We did this so that the full picture of the ditch system could be gained where possible and to ensure that we only had to ask permission for access once.

All landowners have been offered feedback about the findings and this took the form of conversations and written reports where they were wanted.

The total length of ditches surveyed was approximately 30km, and unsurveyed was 1.6km.

Figure 5: Surveyed and unsurveyed ditches in Earnley



A few ditches were not surveyed in detail for various reasons - access and visibility difficulties (e.g. overgrown vegetation and behind high fences).

i Overall results of ditches surveyed

The table below summarises the survey statistics from the ditch condition assessments (see Appendix 1 for ditch condition assessment form used).

Attributes surveyed		%	Notes
Average ditch score	34.5		170 ditches surveyed
Total 'good' ditches (score >40)	37	21	
Total 'moderate' ditches (score 21-40)	130	77	
Total 'poor' ditches (score <21)	3	2	
Ditches which remain wet throughout year	39	23	For the remainder of ditches, it was not possible to record this at the time of surveying
Ditches which are seasonally dry	105	62	
Relative ditch capacity			Measured using data collected for width and depth of ditches
- very high	21	13	
- high	10	6	
- moderate	84	49	
- low	14	8	
- very low	41	24	
Ditches with concrete or boarded sides	2	1	
Buffer width			Includes both sides of every ditch surveyed
- very wide (>4m)	42	25	
- wide (2.1-4m)	45	26	
- moderate (1.1-2m)	65	38	
- narrow (0.1-1m)	14	8	
- not present	4	3	
Average buffer size 1.8 = moderate (1.1-2m)			
Ditches with moderate to high bank erosion observed on one or both sides	6	4	
Litter			Mostly food and drinks packaging, and some agricultural rubbish
- none recorded	106	62	
- litter present	58	34	
- litter abundant	6	4	
Vegetation diversity			7 vegetation types recorded: trees, shrubs, riparian forbs, long grasses, sedges, rushes, reeds
- high (>5 types)	48	28	
- moderate (3-4 types)	77	45	
- low (<3 types)	45	27	
Average number of types per ditch 3.7			
Riparian vegetation			4 riparian vegetation types recorded: riparian forbs, sedges, rushes, reeds
- present	12	7	
- 2 or more types	35	21	
- 3 or more types	123	72	
Channel vegetation			
- present	96	56	
- absent	74	44	

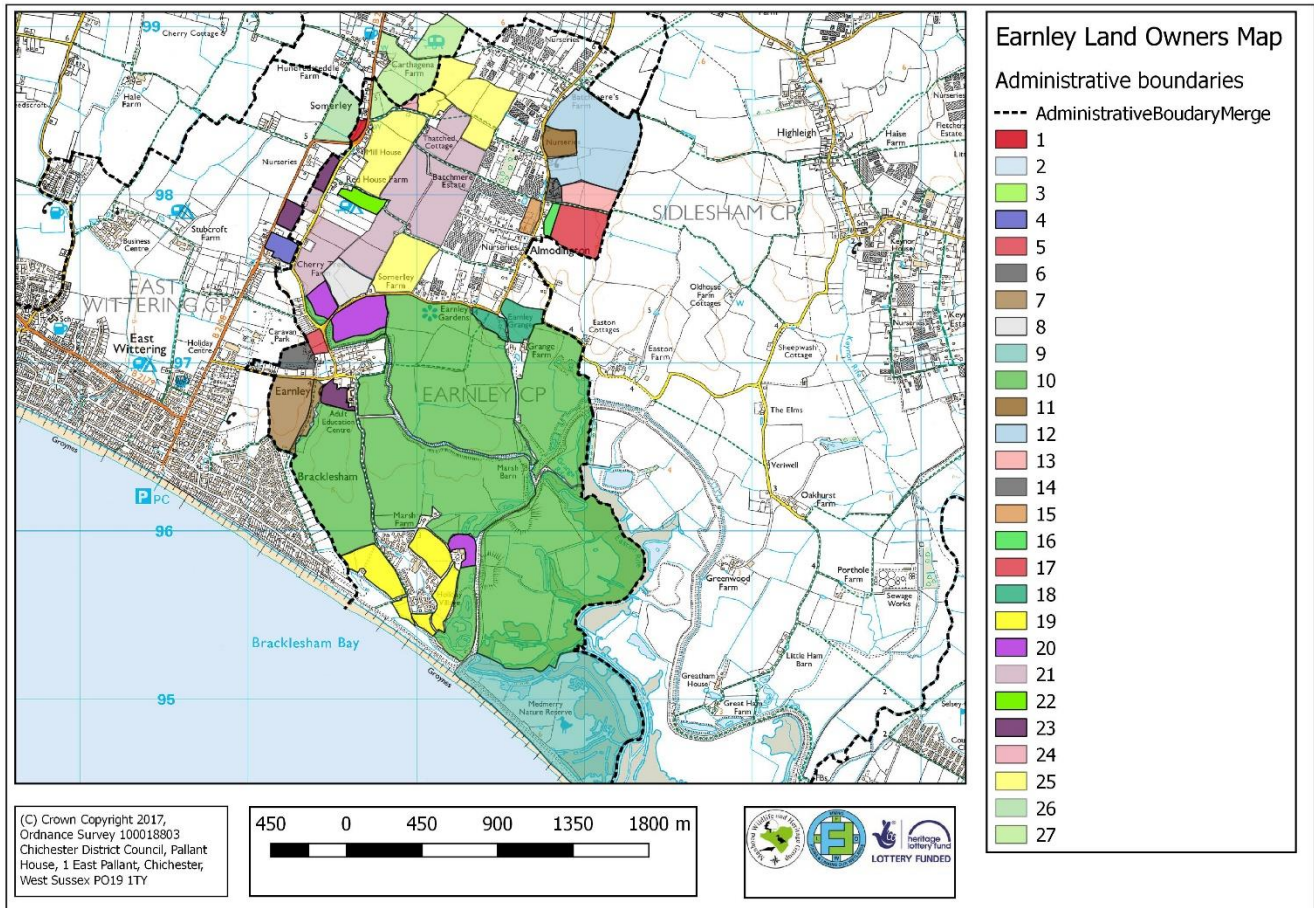
Attributes surveyed		%	Notes
Ditches not managed on rotation	41	24	<i>Ditches with permanent vegetation on one side categorised as 'managed on rotation'</i>
Heavily shaded ditches (>80% shaded)	39	23	
Moderately shaded ditches (40-80% shaded)	65	38	
Ditches with little/no shading (<40%)	66	39	
Thick layer of sediment (>250mm)	23	14	
Ditches with hedge on one or both sides	45	26	

These survey results have been used to create maps in the rest of this section and in **7. Discussion** and **8. Opportunities for improvement works**.

ii Landowners

Earnley Parish is made up of 3 or 4 significant landowners who own and farm the arable land left in the parish. There are then many smaller landowners with small holdings, original Land Settlement Association plots and domestic sized gardens. It was the larger land areas that we targeted as we wanted to study the network of waterways for drainage attributes and biodiversity value. Figure 5 shows the landowner plots surveyed.

Figure 6: Landowners involved in the FLOW project in Earnley Parish



iii Landowner reports

Reports were written for the main landowners where feedback was gained stating that they would like to hear what was found on their land. The reports summarised the result of the surveys, management suggestions given on how water storage capacity could be increased, where wetland habitat could be improved or created, and other observations about the hedgerows, margins and other issues.

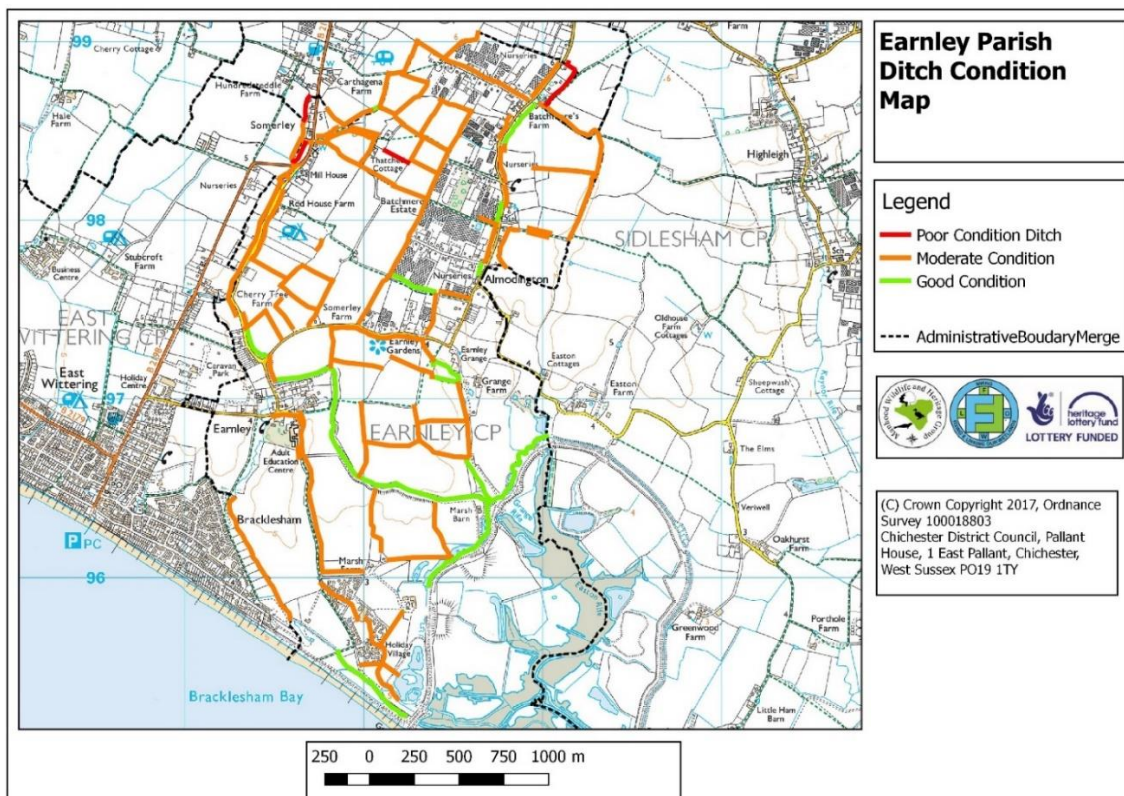
These landowner reports are sent to the farmers and managers and a meeting is offered to go through these findings in detail. These reports are seen as the start of a dialogue and discussion with the landowners so that we can build up a working relationship where we can then offer some advice about habitats, species and ditches in particular, and also volunteer help and possible funding streams to improve some areas of their land over time.

There are field areas on the map that have not been covered (in white) because the fields did not have ditches, and therefore we did not seek access to the land, or the fields were very small and individual owners could not be identified. This totalled a very small amount of land.

iv Condition of the ditches across the Parish

Using the scoring system, we were able to see which areas had ditches with high scores and were considered in good condition, and those with low scores and possible problems. Most of the ditches fell into the 'moderate' category – some of which had potential for improvement but some, which due to their location, original role, physical attributes or neighbouring land management could not be improved.

Figure 7: Condition Assessment of ditches in Earnley



A high scoring ditch would be one that was large, had water all year round, good vegetation cover on the banks, had a range of vegetation in the water and on the banks, and which also had a hedge associated with it.

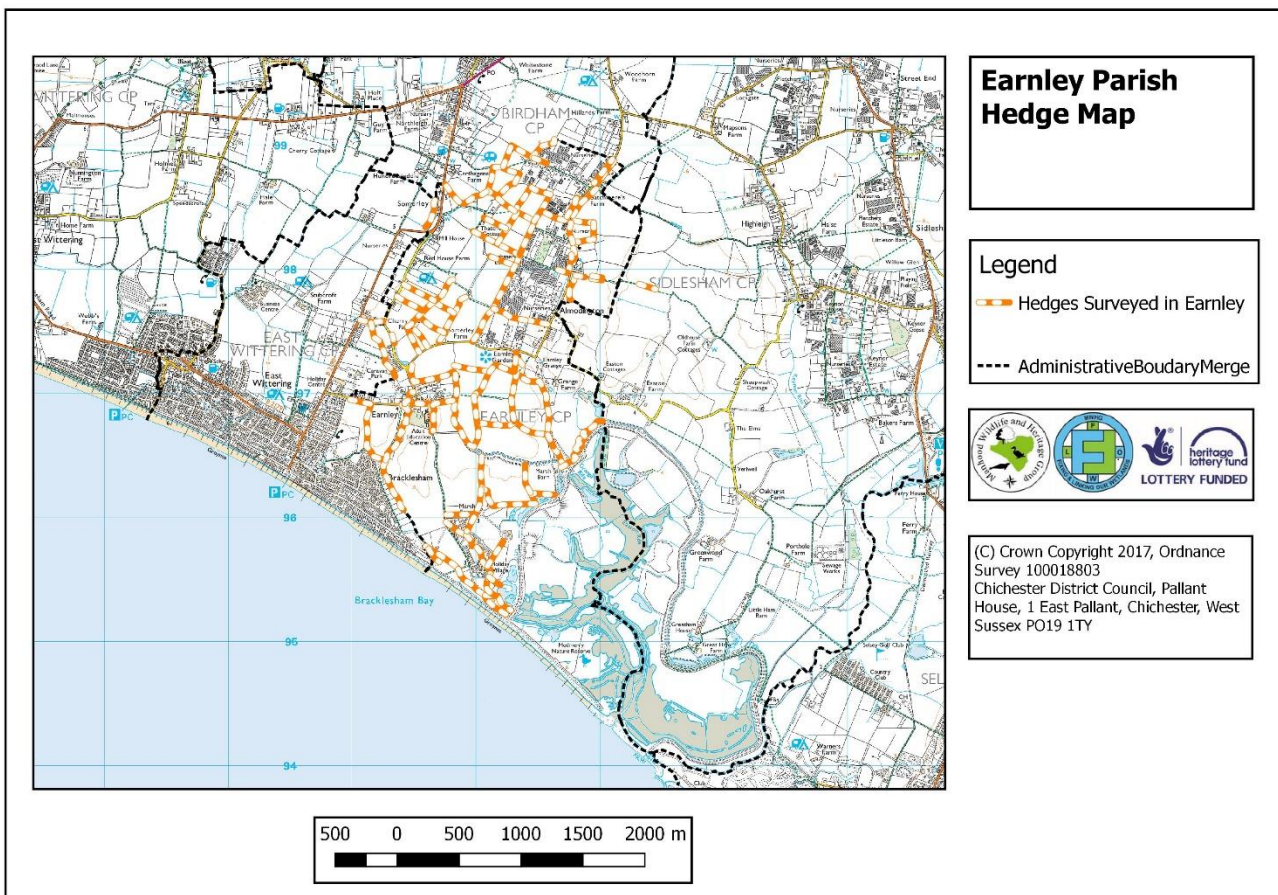
Poor ditches varied from being completely overgrown with bramble so that they couldn't be seen, to being very shallow, bare earthed and dry most of the year. Most ditches were seen with vegetation of either one or both sides and none had been over managed with complete vegetation removal.

v Hedges surveyed across the Parish

The hedges surveyed were primarily those associated with ditches and 54 hedges were assessed and recorded, which totalled over 4.96 kilometres in length.

The hedges ranged in age, structure and management, with 81% containing bramble, 57% with Hawthorn (*Crataegus monogyna*), 63% with Blackthorn (*Prunus spinose*), and 55% with English Oak (*Quercus robur*) as is typical for the area.

Figure 8: Surveyed Hedgerows in Earnley



Other tree species were seen in the hedges, with percentage of hedges with that plant species:

- Goat Willow (*Salix cinerea subsp.*) (52%)
- Hazel (*Corylus avellana*) (50%)
- Field Maple (*Acer platanoides*) (46%)
- Gorse (*Ulex europaeus*) (7%)
- Sycamore (*Acer pseudoplatanus*) (7%)
- Privet (*Ligustrum Ovalifolium*) (7%)

- English Elm (*Ulmus minor var. vulgaris*) (33%)
- Ash (*Fraxinus excelsior*) (28%)
- Dogwood (*Cornus sanguinea*) (22%)
- Elder (*Sambucus nigra*) (22%)
- Holly (*Ilex aquifolium*) (13%)
- Poplar (*Populus sp*) (9.2%)
- Rowan (*Sorbus aucuparia*) (2%)
- Wild Cherry (*Prunus avium*) (2%)
- Whitebeam (*Sorbus aria*) (2%)
- Horse chestnut (*Aesculus hippocastanum*) (2%)
- Leylandii sp (2%)

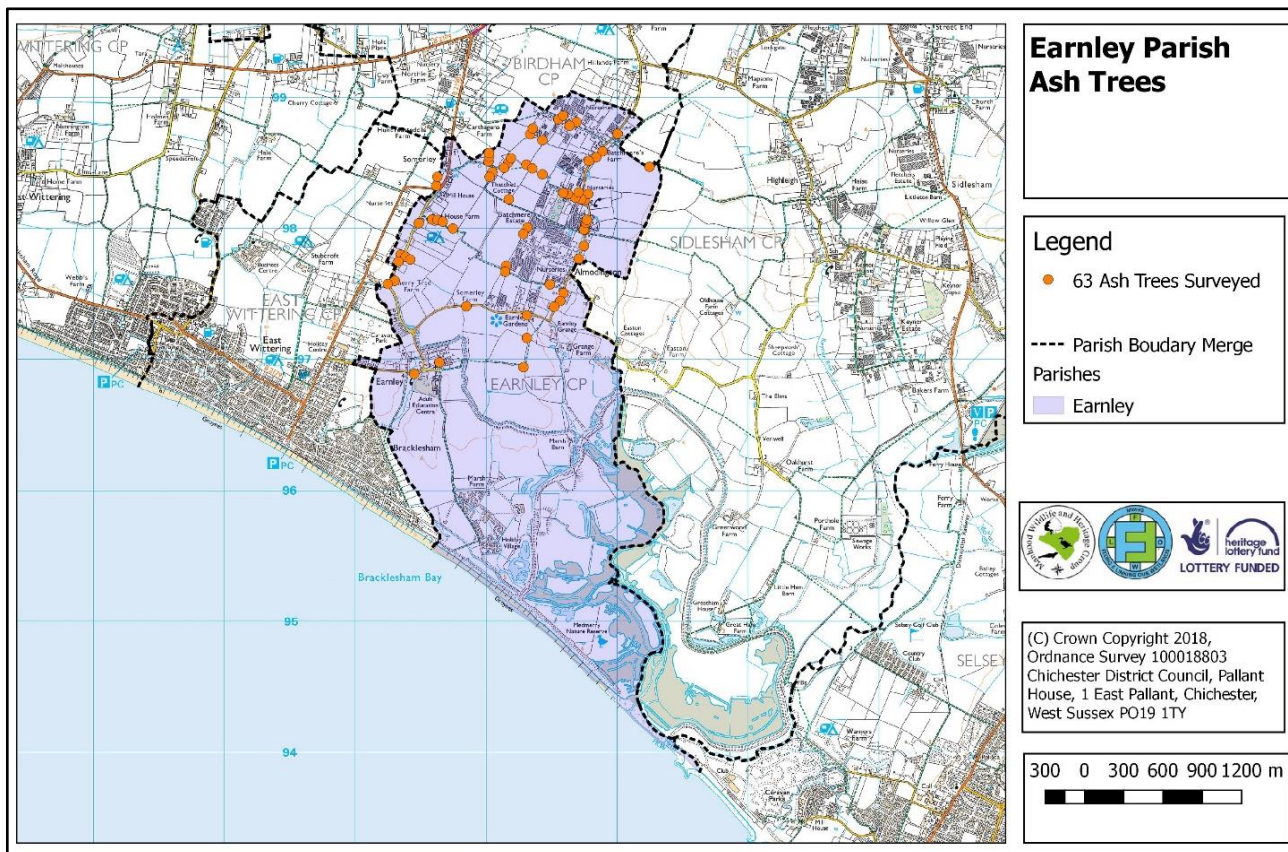
Other plants species of significance seen within the hedge were:

- Ivy (*Hedera helix*) (41%)
- Wild rose (*Rosa arvensis*) (22%)
- Native honeysuckle (*Lonicera periclymenum*) (13%)
- White Briony (*Bryonia alba*) (2%)
- Dog rose (*Rosa canina*) (2%)

vi Ash tree census

When walking the ditches and looking at hedges and the tree species within them, the location of Ash trees was noted. There were not many Ash trees seen in this parish and much of the land is very open with few wooded areas. There were no signs of Ash dieback detected.

Figure 9: Ash tree census for Earnley



7. Discussion

The Manhood Peninsula Surface Water Management Plan (MPSWMP) 2015, commissioned by WSCC, focusses on flooding events that took place in 2012/2013 on a parish by parish basis. It looks at actions that need to take place to reduce future flood risk and identifies individual issues and problems. In Earnley there was an opportunity for the Parish Council to meet with the authors of the report to talk through issues in the parish and many problems were reported and detailed actions taken for solutions. There were 5 actions detailed and the majority have been carried out using EA, WSCC OW, and private funds, with the remaining due to be completed.

This project focussed its work on identifying opportunities to improve drainage and biodiversity opportunities on the farmland where ditch and ponds could be examined, and not land built up with culverts.

i Earnley's key waterways

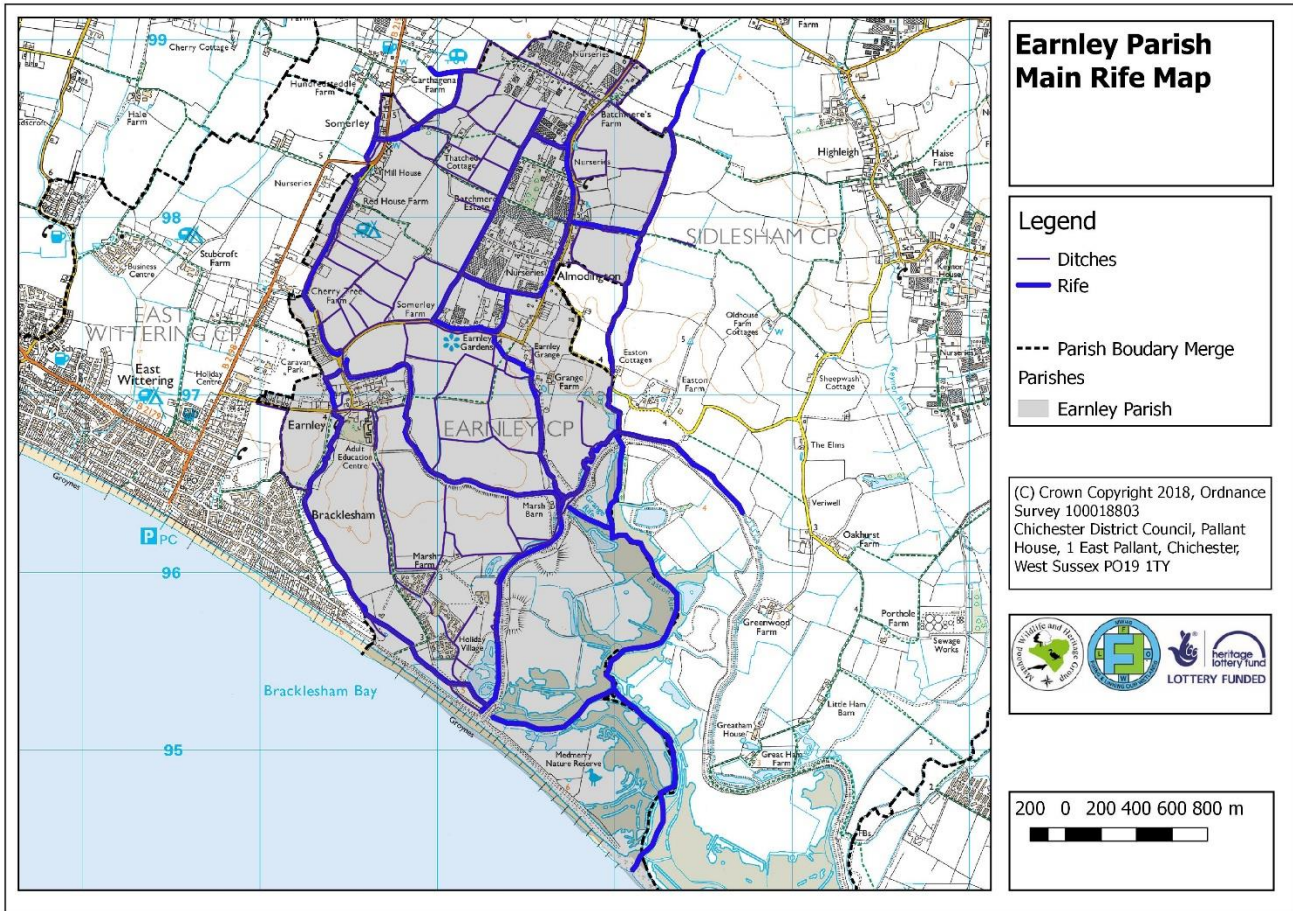
As noted in the MPSWMP, primary conveyancing routes have been identified in the parish and their condition was focused on. These are *'the critical routes of the drainage network which will cause the most significant flooding to property and infrastructure if they are blocked or poorly maintained (NB: these routes include all of the Rifes, and builds upon the 'key transport routes' initially proposed by Royal Haskoning in 2006)'*

There are seven main routes for water to travel through to get out to sea and a couple of these rifes have different names along their length:

- Grange Rife
- Almodington Rife
- Earnley Rife
- Broad Rife
- Easton Rife
- Jolly Rife
- New unnamed section of rife

These rifes are larger channels that pick-up water from farm drainage and roadside highways ditches and are key to the water storage and movement capacity of the drainage system of the parish. They are also key for environmental connectivity as they hold water for longer and have the potential to be hotspots for wetland biodiversity with good management. These rifes do not just drain water from Earnley Parish but also take water from East Wittering and Bracklesham to the west of the Manhood Peninsula, Sidlesham Parish to the east and north, and Birdham to the north.

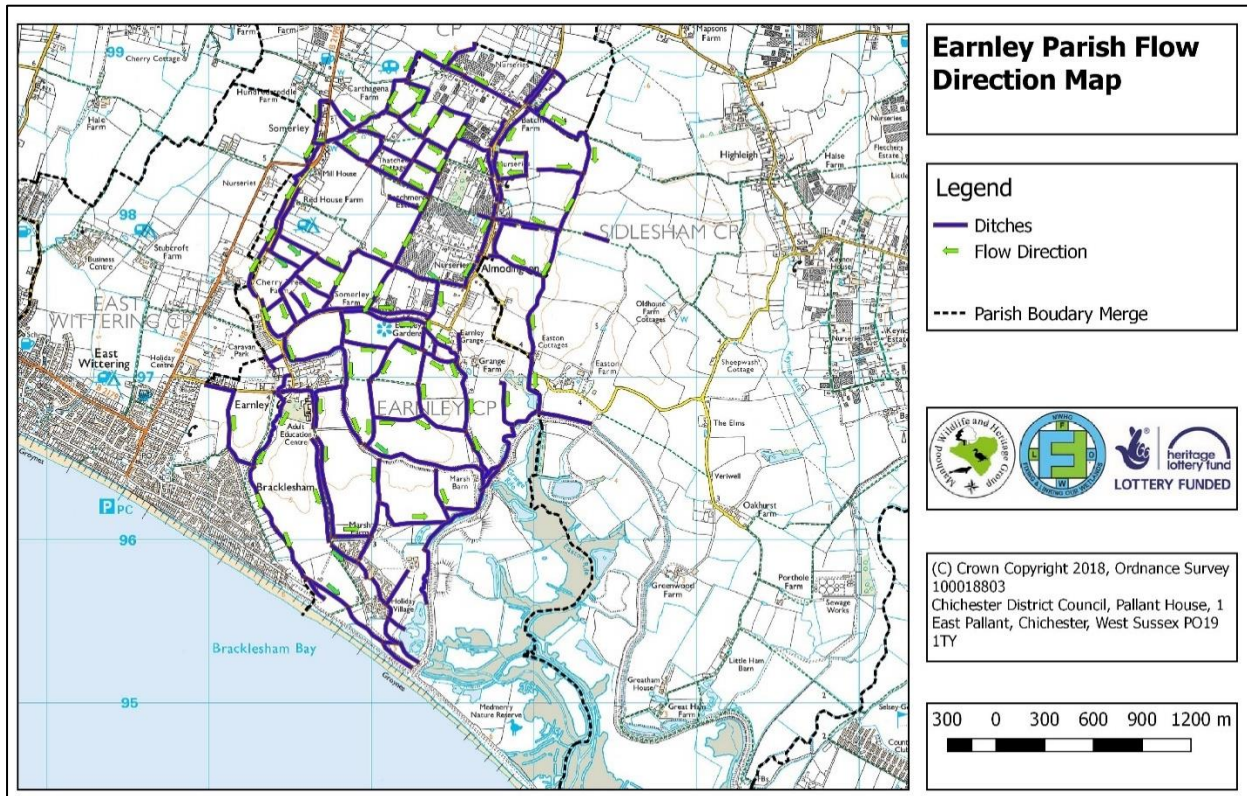
Figure 10: Main Rife map of Earnley



These waterways need to be prioritised for any clearance and maintenance work as they are key to the conveyance of water. If they become blocked or are overwhelmed they will have the largest impact on people, properties and roads. Investigation of sites adjacent or connected to these that could be used as temporary water storage areas was explored.

Figure 11: The flow direction in Earnley Parish ditches

Figure 11 displays the flow direction, where it could be discerned. This was not always an easy piece of information to gather as the land is so flat that often the ditch just holds the water and it does not flow unless there is significant volume in the channel. Even then the surface of the water can look quite static while there is some flow underneath.



ii Overall condition of the ditches

Figure 8, a map of the condition assessment results in Earnley, clearly shows that the majority (77%) of the ditches in the parish are in 'moderate' condition and that only 2% were 'poor'. However, as previously stated this scoring is relative and boundaries between categories must be made. As such some moderate ditches will be marginally inside the required scoring band and should be considered, where appropriate, as a priority for improvement or further monitoring. The fact that 37% of the ditches are shown to be in good condition may be skewed by the high number of rifes with larger margins and all year-round water availability.

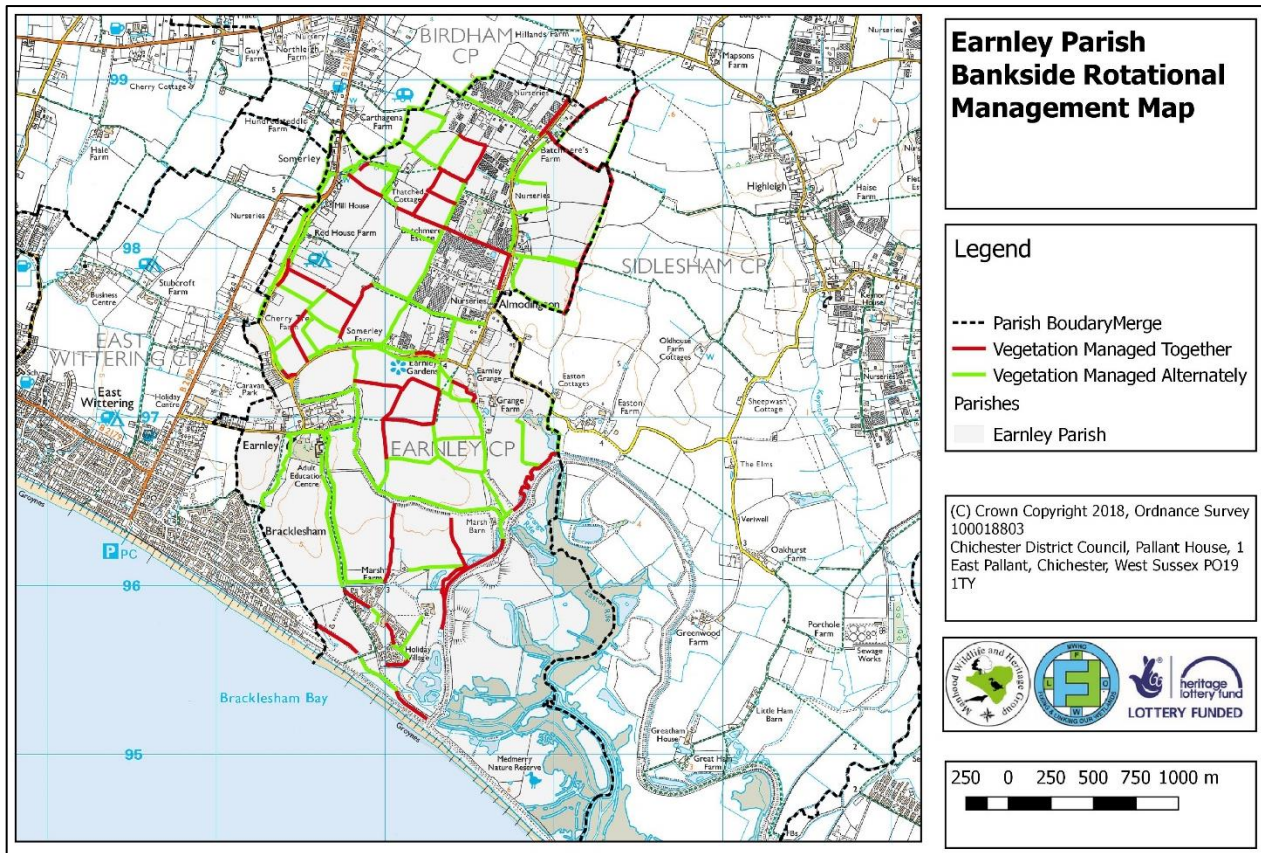
The physical and biological condition of the ditches is primarily influenced by their management regime and therefore different landowners tended to have ditches that were characteristic to them with similar adjacent land uses, managed hedges and banks looking homogenous. This was also influenced by their position within the parish, their proximity to the sea, and the influence of the wind.

It can be seen that 76% of the ditches in the Parish are managed on a rotational basis with only one bank being cut at a time. This may be because many of the ditches have hedges associated with them and therefore it is only practical to do one bank or because vegetation was only cut on one bank per year as is best practice.

It was seen that 24% of ditches had both sides managed every year and while this appears to open up the channel for water movement, it can actually contribute to bank erosion, depending on the height and type of vegetation cut. It also tends to lessen the biodiversity value of the ditch.

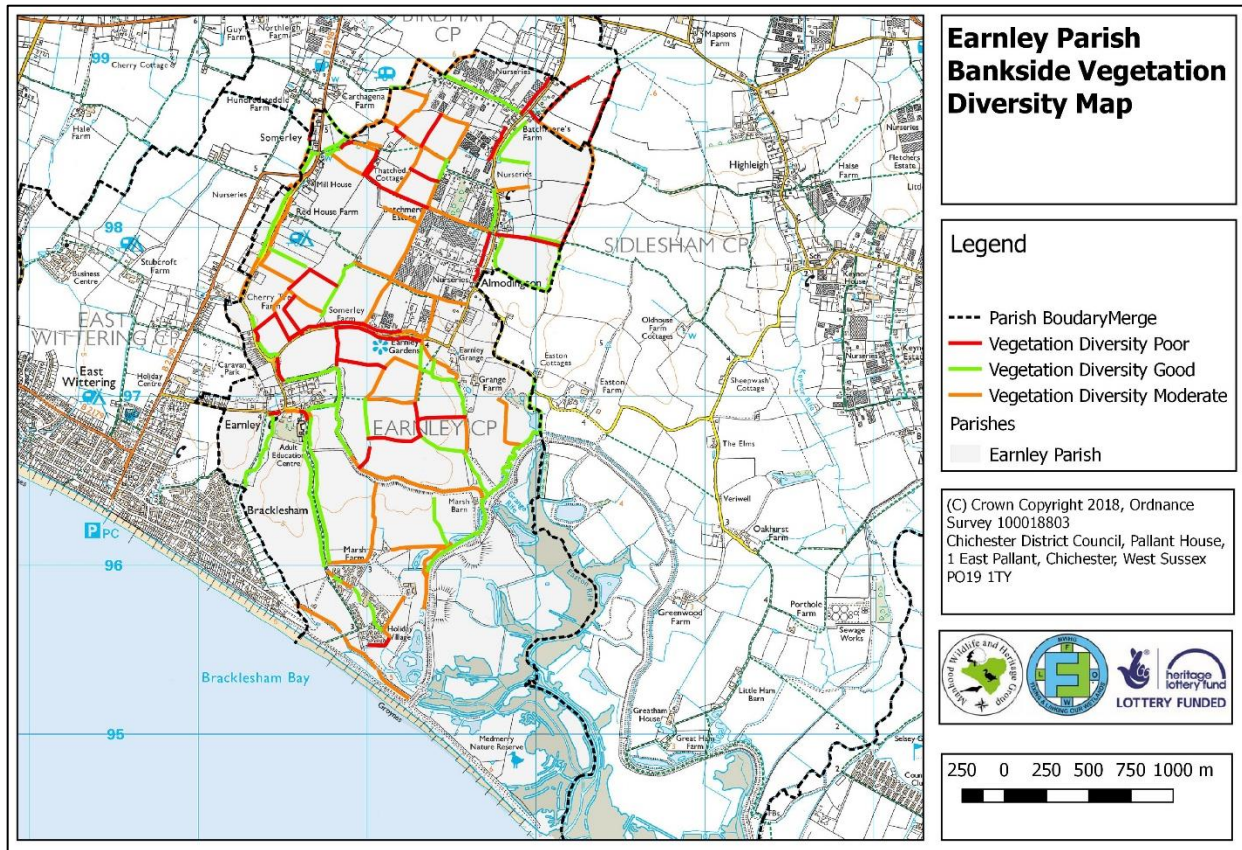
During the examination of the ditches, culverts were also inspected, where it was possible to do so, and it was noted where some culverts were silted up or looked in poor condition.

Figure 12: Rotational Management of ditch banks in Earnley



The management regimes that the ditches experience is reflected in their appearance and their biodiversity. There will also be factors relating to their wider environment such as water quality, availability of year-round water and wind. In order to gauge the biodiversity of the ditches we recorded the diversity of vegetation types present on ditch banks. The 7 different vegetation types recorded were: trees, shrubs, riparian forbs, sedges, rushes, reeds and long grass.

Figure 13: Diversity of vegetation types on ditch banks in Earnley



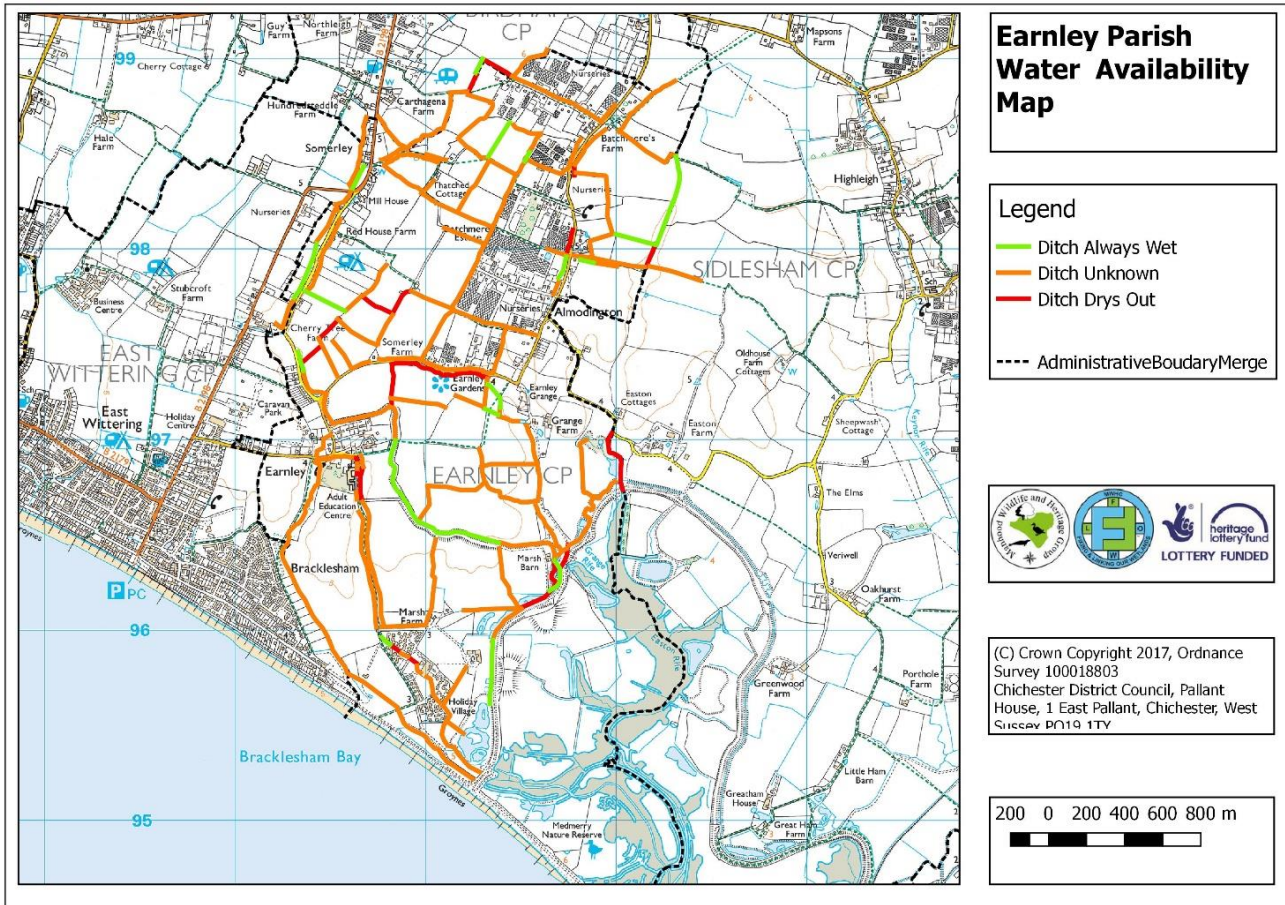
It can be seen that there were some areas with very little plant diversity at all while some ditches were noticeably better.

Often where there was just one species or two recorded, it was either a grass species or a bank of nettles. The timing of the surveys will have had an effect, those ditches surveyed in October would be more likely to score low having just been cut.

The general pattern was that where ditch bankside vegetation was cut on both sides every year, then these had less number of plant species present. Where the map shows a rotational management scheme and a ditch with low vegetation diversity, this could be explained on examination by a land use or other environmental issue.

One of these is water availability as it is common for the ditches on the MP to dry up during the summer, as there are often long periods without significant rain. Some of larger ditches and rifes, and some ponds, will hold water for longer and these are particularly important for wildlife such as water voles, amphibians, dragonflies, aquatic invertebrates and birds. Earnley had a relatively large number of ditches that stayed wet all year round (23%) and this is influenced by the rifes running through the parish.

Figure 14: Water availability in ditches surveyed in Earnley



iii Management for water voles

One of the key species in the area is the water vole (*Arvicola amphibius*), the fastest declining mammal in England, (Strachan et al. 2011), and it lives in the linked-up waterways of the MP and is considered a regionally important population. Water voles have specific habitat requirements that include the all year-round availability of water and good vegetation coverage on soft earthy banks with a wide range of plant species. These needs do not sound onerous, but water voles do not hibernate, spending much of the winter in their burrows with cached food, but they prefer undisturbed vegetation on the banks all year round for cover and quite steady levels of water. On the MP, it has been noted that water voles do use ditches that dry out as part of their habitat and seem to use the linked network of ditches to move to wetter areas and ponds as condition change.

Looking at Figures 10 and 11, water voles are most likely be found in the areas where there is most water year-round and a wide range of plant species. It can quickly be seen that this reduces the number of suitable water vole ditches in the parish.

A management regime that cuts just one side of the bank every year, puts the debris away from the channel, and even leaves some areas untouched on a 4-year rotational basis will benefit water voles the most. Placing small bunds in the ditch, at a low level, to hold water back in the spring will keep the ditches wetter for longer and encourage water voles to stay.



Fixing and Linking Our Wetlands



Earnley Parish ditch condition assessment results and habitat improvement plan

The EA document '*delivering consistent standards for sustainable asset management*' Version 3 March 2012 lays out various cutting regimes available, with timings and frequencies, the range of bankside cuts, in-channel vegetation removal, silt removal etc, with wildlife and other factors in mind. Management can take place of ditches but it needs to be sympathetic. Where water voles have been identified as being present then advice should be sought from the EA about the habitat management as under the Wildlife and Countryside Act 1981, updates 2006, it is an offence to interfere with water vole habitat and a license from NE would be required for work.

Water voles leave very clear indications of their presence and can be easily and quickly surveyed for. The SxBRC will have historic records of their locations but it is presumed by WSCC that they are present in all ditches on the MP and therefore this must be checked before work goes ahead.

iv Limitations of the study

The ditch condition assessment form was created using an Assessment Form that had originally been developed to assess water vole habitat, was then adapted for use during the Birdham and West Itchenor ditch studies and was further evolved to take in more environmental and physical characteristics. The form has a scoring system so that ditches could be rated as 'Good', 'Moderate, and 'Poor' and a traffic light - Green, Amber and Red system used so that on maps it could be instantly seen which ditches would form the focus of management recommendations.

Although this form was used, and a score given to all the ditches, it soon became evident that most of the ditches were amber, meaning in 'moderate' condition. We realized that the scoring system had severe limitations as the ditches have so many characteristics that it is impossible to accurately represent this with a number. It might be best to break this down into a physical attribute score, a biological score, an environmental score (for the surrounding habitat), and a management score. A well but sympathetically managed ditch can be good for water flow and storage and for wildlife but capturing that as a single number is not realistic. Therefore, maps have been created that look at the specific attributes.

The water quality was not analysed during this project, but it would be useful in future to get a picture of specific issues in particular locations. We have been able to infer some runoff and pollution incidents from the vegetation and the state of the water itself but there would be value in gaining information on the specifics and subtleties across the area. This information can then be used to find the sources of the problems and address them.

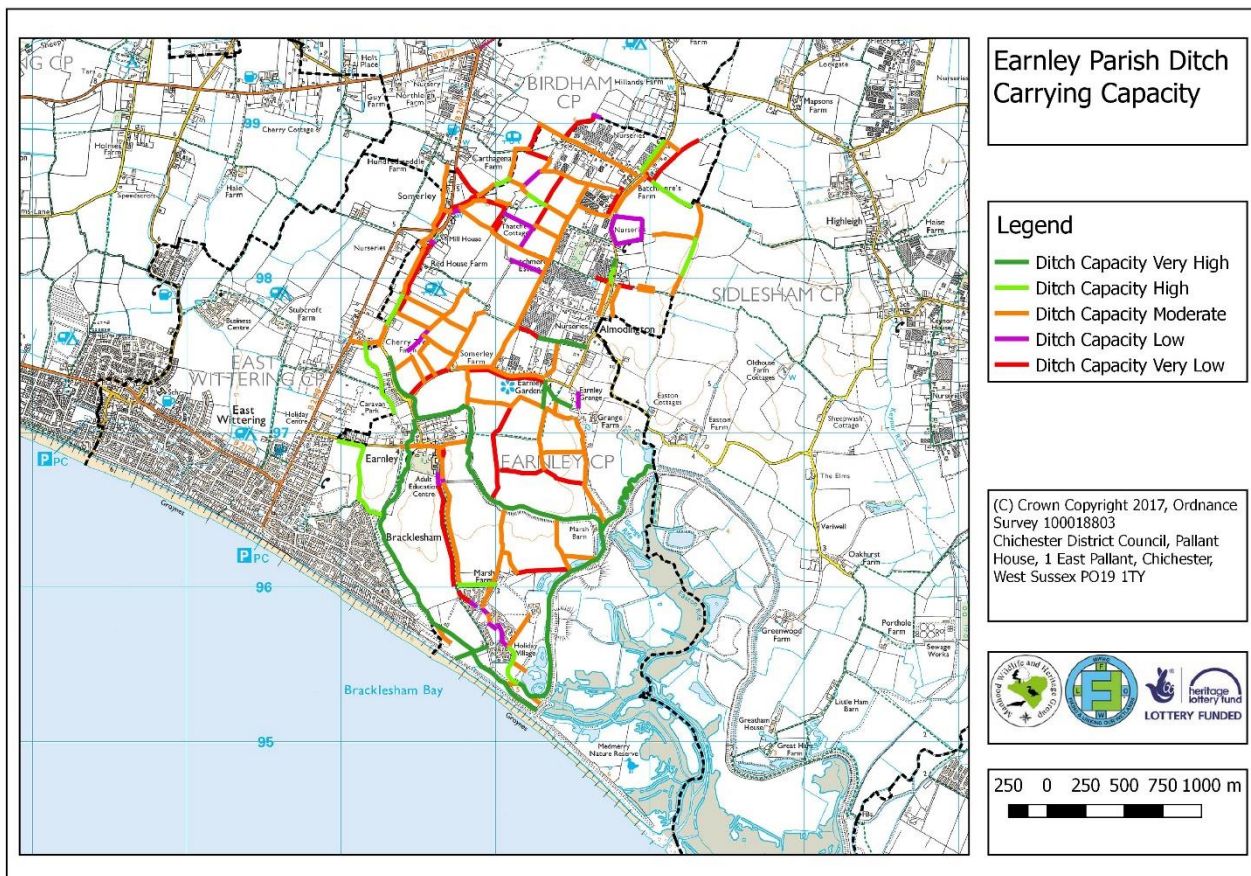
8. Opportunities for improvement works

Through the detailed fieldwork and data gathering that we have carried out, combined with the desk based study of the information provided by WSCC, CDC, EA and other organisations, we have looked for opportunities to improve the water carrying capacity of the ditches and ponds, and to also find benefits for wildlife.

The findings have been divided into areas for opportunities and areas with issues that need action or some form of resolution.

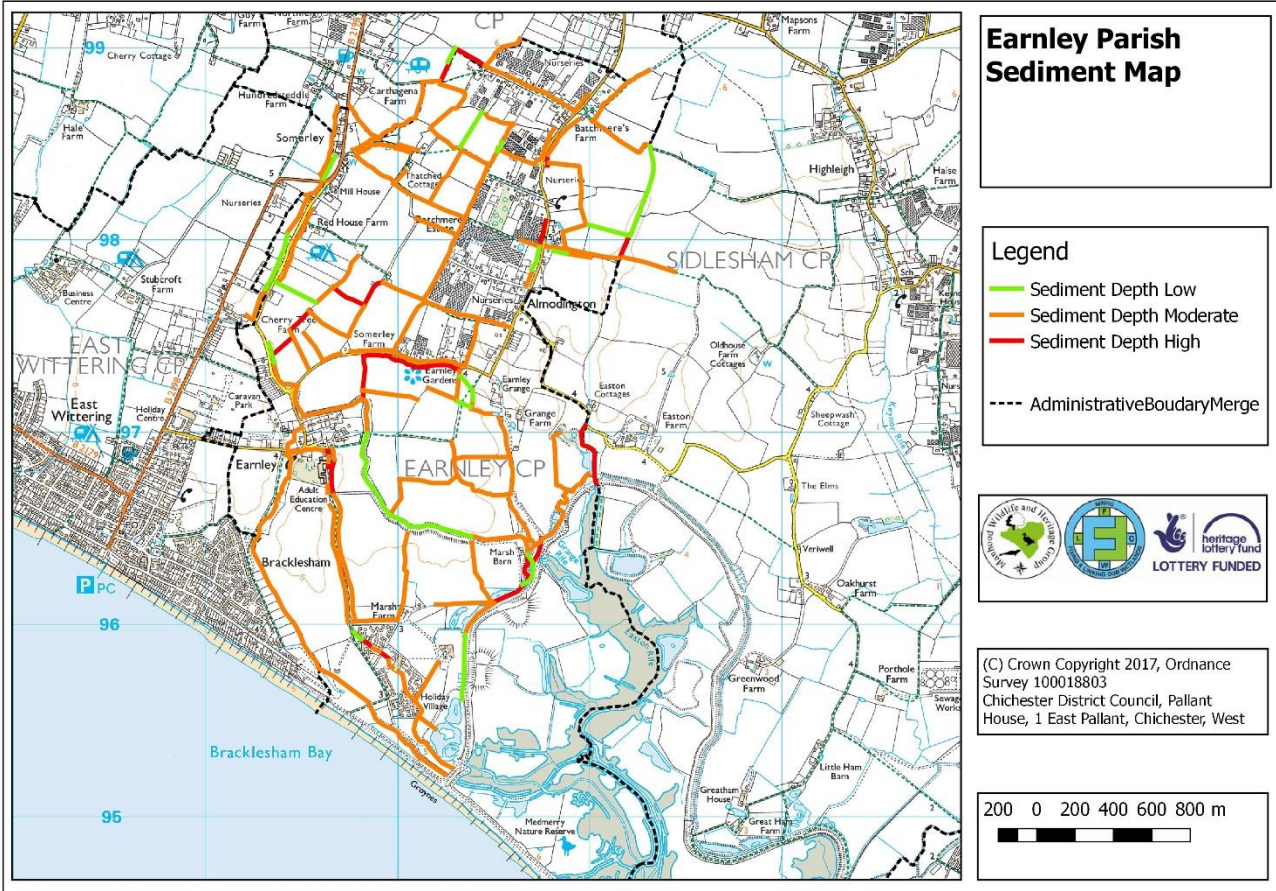
In order to look at opportunities for improvement the approximate capacity of the ditches and waterways was calculated from the ditch widths, depth and lengths that we had gathered and the mapped, see Figure 15. This illustrates which ditches have the potential to hold more water and confirms the positions of the primary conveyancing routes.

Figure 15: Approximate measure of the capacity of ditches surveyed in Earnley



Related to this was the sediment amount recorded in ditches and this information was gathered and mapped. The primary conveyancing routes and most of the ditches on farmland do not appear to have much silt, and it was approximately 11 ditches that had silt deeper than 250mm.

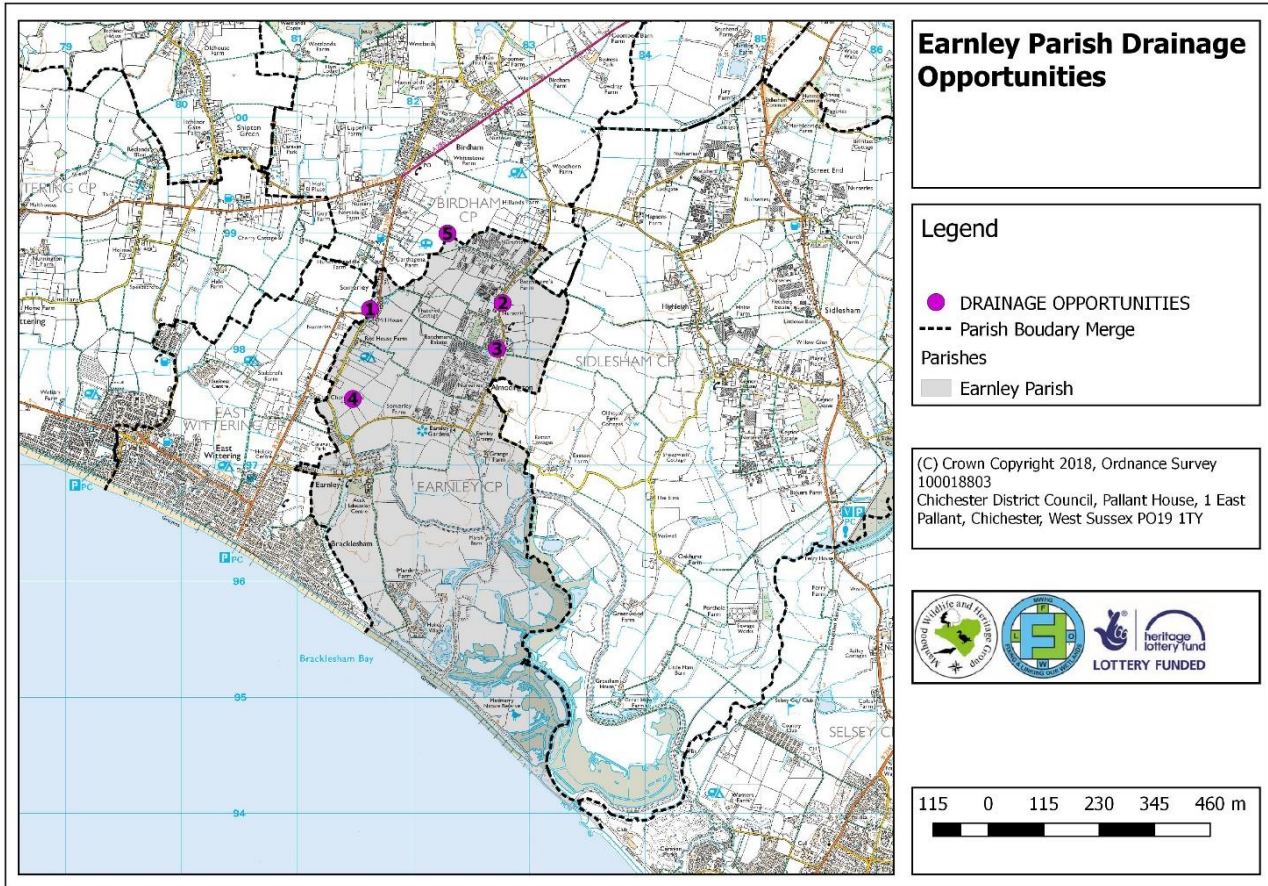
Figure 16: Sediment depth in ditches surveyed in Earnley



i The opportunities

The opportunities found have been split into those which primarily benefit drainage and those which have mainly environmental benefits.

Figure 17: Drainage opportunities identified in Earnley



a) Drainage improvement opportunities - For flood relief and water storage opportunities (new ponds, culvert removal, ditch digging)

The table below shows the opportunity found to improve drainage. The location can be seen on the map in Figure 17 above.

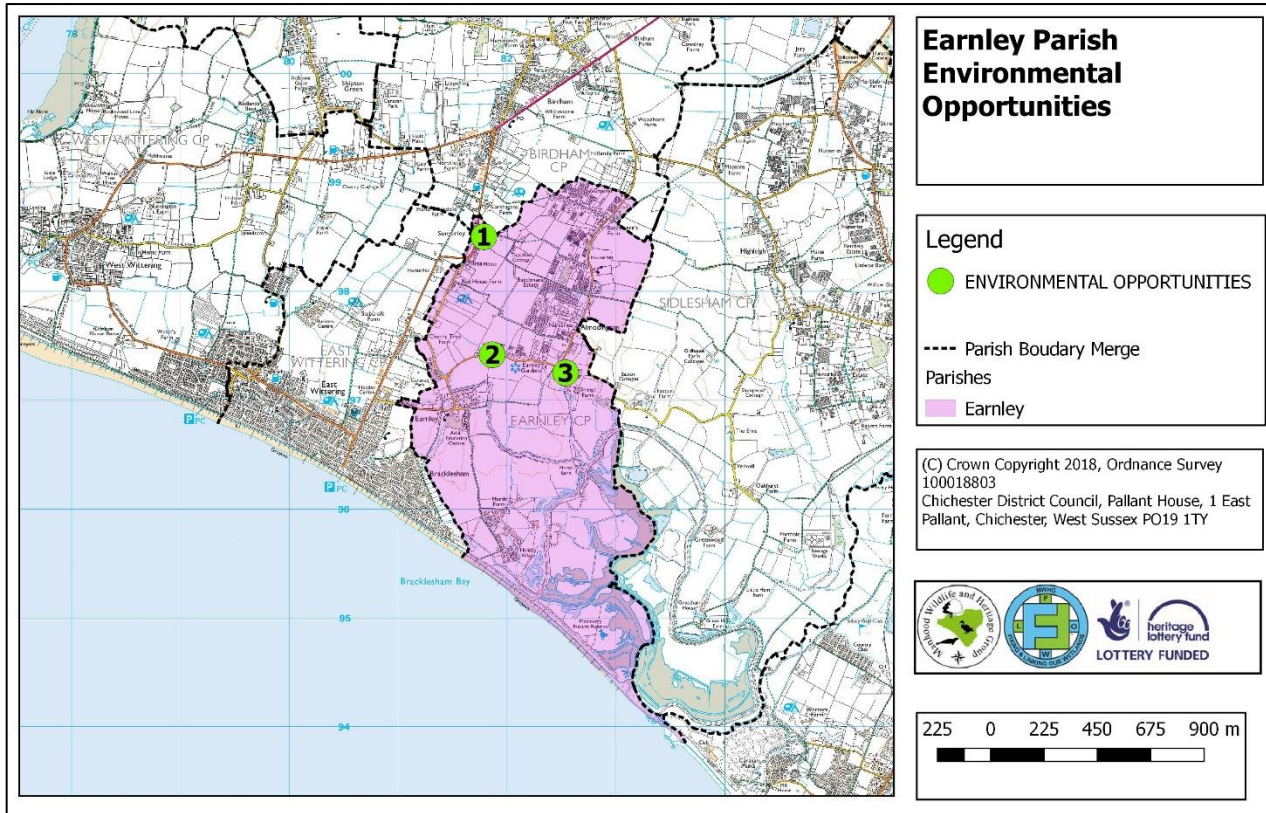
id	Detail	Type	Benefit	Priority	Responsibility
1	There is a relic ditch here that could be put back into production.	Opportunity/ Issue	Drainage	H	Landowner /FLOW
2	This relic pond is full of debris and silt - it could be dug out to take water off the road.	Opportunity/ issue	Drainage	M	Landowner /FLOW
3	A rain garden could be put in to tank some of the water going into the rife from the glasshouse	Opportunity/ issue	Drainage	M	Landowner /FLOW
4	Dry ditches that if desilted would tank more water	Opportunity/ issue	Drainage	L	Landowner /FLOW
5	Dry ditches that if desilted would tank more water	Opportunity/ issue	Drainage	L	Landowner /FLOW

A more detailed description of the problem and proposed improvements provided.

id numbers & location	Issues / opportunities	Proposed improvement
1 Sparrow Cottage	This relic ditch is evident but shallow and fringed with willow trees. It if were dug out and re-joined to the nearby rife system it would help to divert water away from the property that has been flooded in the past.	By digging out this ditch and an adjacent pond area, the tanking ability of this site will improve during high rainfall events and hold water away from the property. It will also benefit wildlife. Laying the willow and planting other tree species will also keep the banks stabilized, utilize the water and provide food and habitat for a range of species. It will also improve connectivity to the east and north of the cottage. Drainage and environmental benefits
2 Haydons Pond	This relic pond is in two parts and one section would benefit from being dug out and debris removed to hold more water.	By improving the pond, it will be able to take more water off the Batchmere Road, where there has been a high incidence of flooding in the past. By opening up one side of this pond, the habitat would be improved, and it could become an attractive site for water voles as it holds water most of the year. There is a colony of jet black ants (<i>Lasius fuliginosus</i>) and the rare giant oak aphid (<i>Stomaphis quercus</i>) living on a tree in this pond and therefore care would have to be taken with any work. Drainage and environmental benefits
3 Biotechnology Nursery	The glasshouses here send water straight into Almodington rife, a percentage of which could be stored in a rain garden.	By holding back water on this site it will prevent inundation of the rife during high rainfall events. The raingarden also acts to filter out debris and pollutants as water passes through it while also providing a new habitat - therefore it has both environmental and drainage benefits
4 Cherry Tree Farm	Desilt ditch section and deepen.	The ditch would hold water for longer, have more capacity and be better habitat for wildlife. Drainage and environmental benefits
5 Cathegena Farm	De-silt the junction section of ditches to hold more water	A couple of the ditches were dry and full of debris when most other ditches were holding water. Digging out the junction area would have benefits for water storage and wildlife. Drainage and environmental benefits

b) Environmental improvement opportunities - *For the improvement of the ditches, their vegetation diversity, the margins, the hedgerows and the creation of wetland areas.* The location of these sites can be seen in Figure 18.

Figure 18: Environmental opportunities identified in Earnley



The table below shows the opportunity found to improve the environment and wetland habitat.

id	Detail	Type	Benefit	Priority	Responsibility
1.	Pond management	Opportunity	Environmental	M	Landowner /FLOW
2.	Pond and ditch	Opportunity	Environmental	M	Landowner /FLOW
3.	Pond improvement	Opportunity	Environmental	M	Landowner /FLOW

The table below numbers the opportunities found that relate to environmental improvement.

Id number and issue type	Responsibility	Problem and proposed Improvement
1. Somerley Lane	FLOW / Landowner	The ditch system flows south into a pond adjacent to Somerley Lane and flows into Sparrow Cottage. The pond is over shaded by Willow and holds little conservation value. The pond also contains a high percentage of silt in the Northern corner.
2. Almodington Lane south	FLOW / Landowner	The ditch on the roadside frequently contains rubbish and little riparian vegetation. Laying the intermittent hedge, removing the barbed wire fence and gap filling

Id number and issue type	Responsibility	Problem and proposed Improvement
		with native tree species will lower this hedge, thicken it and allow light to get to the ditch, allow better riparian habitat.
3. Earnley Grange	FLOW / Landowner	The pond contains lots of silt and vegetation. This allows the pond to dry out and increases the abundance of terrestrial vegetation. Digging it out would allow it to hold water for longer and to be attractive to wetland species.

When considering improvement work on a large scale, there are issues that must be taken into consideration and these have been identified in the MPSWMP:

- Landscape issues
- Historic environment
- Water
- Geology, soil and geomorphology
- Biodiversity, flora and fauna

ii High level physical works

This will be used on sites where ditch and pond banks require reprofiling, junction ponds are created, and silt is removed. Contractors maybe needed for this work, but the preference would be for the landowners to carry this out as they know their land intimately and can fit the work in with cropping regimes or other work on the land.

A significant issue when carrying out ditch or pond work and spoil or silt is removed, is what to do with it. Taking it to landfill can be a significant cost to a project so where possible, spreading it on adjacent land or using it to create higher banks would be preferable. It may be that a D1 exemption certificate maybe needed from the EA to do this (to prevent the spreading of contaminated spoil on land for food production): www.gov.uk/guidance/waste-exemptions-disposing-of-waste

See Appendix iii for a costed plan of the suggested work.

iii Low level physical and maintenance work

As part of the landowner reports and follow up dialogue opportunities are identified for wetland, hedge and habitat improvement and this could take the form of physical works that involve landowner machinery or contractors. Lower level work could be carried out by volunteers.

Volunteers can carry out a range of tasks:

- Hedgerow improvement – planting new hedges, filling in gaps in hedges, and laying hedges
- Sympathetic ditch and pond maintenance removing vegetation – bramble and bankside vegetation
- Biological survey work– water voles, amphibians, botanical, invertebrate, bat and bird.

9. Other environmental Issues found

During the course of our work we have come across a range of land management issues (discussed above) and these have been discussed with the individual land owners via reports and face to face meetings. However, it is worth noting them here as they can have an overall cumulative effect on the environment of the parish.

i Water Quality

The EU Water Framework Directive was adopted by the UK in Dec 2000 and it covers water quality in river catchments, in groundwater and aquifers, the abstraction of water, and runoff from all sources and pollution types.

While we did not analyse the water quality in Earnley we were aware of the symptoms of runoff, particularly of nitrates and phosphates, and where possible we noted their source. Most arable farms use nitrates based fertilisers intensely and there is no organic farming in the Parish. The ditches, where they have a good margin and a range of riparian vegetation on the banks, even small relic reedbeds can utilise this nitrate runoff and 'mop it up' before it gets passed on through the water course. If the nitrates stay in the water this can lead to eutrophication and significant algal growth which uses up all the oxygen in the water. This effectively kills all other species so that no invertebrates or other aquatic plants can survive and so the water way loses its biodiversity. Even ditches with vegetated margins can become covered in algae and blanket weed as field drains bypass this vegetated fringe and deliver water directly into the ditch.

Blanket weed, and algae were seen in many ditches and, as this was not a specific item to note on our original ditch condition assessment form, we did not map it.

Nitrate and Phosphate analysis

Over the course of the FLOW project University students carry out individual pieces of research and a Masters student, Claire Lipop, from the University of Oxford spent the 2017 summer assessing water vole habitat across the MP, (C. Lipop 2017). She looked at ponds and waterways, their vegetation structure, water levels and some water quality issues. During her analysis she checked the phosphate and nitrate levels of these areas and 5 sites were in the Parish of Earnley.

Nitrate levels: of the 5 sites looked at for nitrate levels, 2 were free of nitrate pollution, 2 showed slight levels, and 1 had significant levels of nitrates in the water. The factor here seemed to be the size of the waterway/pond and the larger the channel/wetland, the higher the nitrate levels. This may be due to the fact that the larger waterways receive water from other sites and, so they gain runoff from many farmers' fields and it has had a cumulative effect. One of the sites to register higher levels of nitrates was the new Earnley Flood Channel and it may be that the vegetation in this channel is not yet colonized enough to help absorb these nitrates. This channel was not planted up and over time it is slowly developing riparian vegetation that can help to combat the pollution.

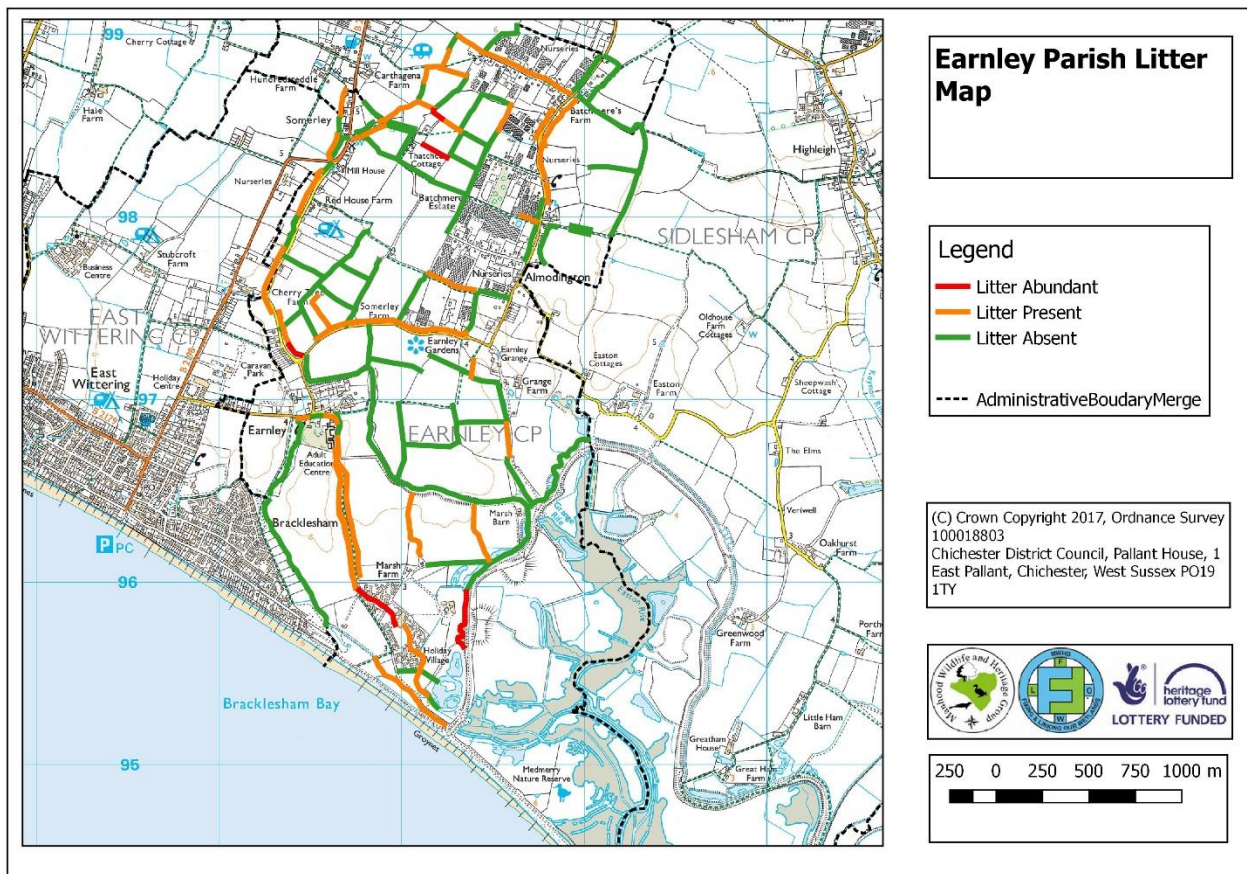
Phosphate levels: of the 5 sites studied only 2 of the sites showed significant phosphate levels, both connected - Bookers Lane ditch and, again, the Earnley Flood channel. Both receive water from the north of the Earnley Parish, and also part of East Wittering and Bracklesham Parish. This is a large catchment with arable farming

and the ditches will have picked up the phosphate through runoff. By not overmanaging these ditches and allowing the vegetation to grow on the banks and in the water, it may help to combat the effects of the high phosphate levels.

ii Litter

We came across litter in many of the ditches that we surveyed and this partly because it is such an open and flat parish that litter blows across fields and gets caught in the hedges and then falls into the adjacent ditches. Some of the ditches were worse than others, but this litter is a threat to wildlife, water quality and may end up in the sea where it also becomes a hazard.

Figure 19: Ditches containing litter in Earnley



iii Hedges

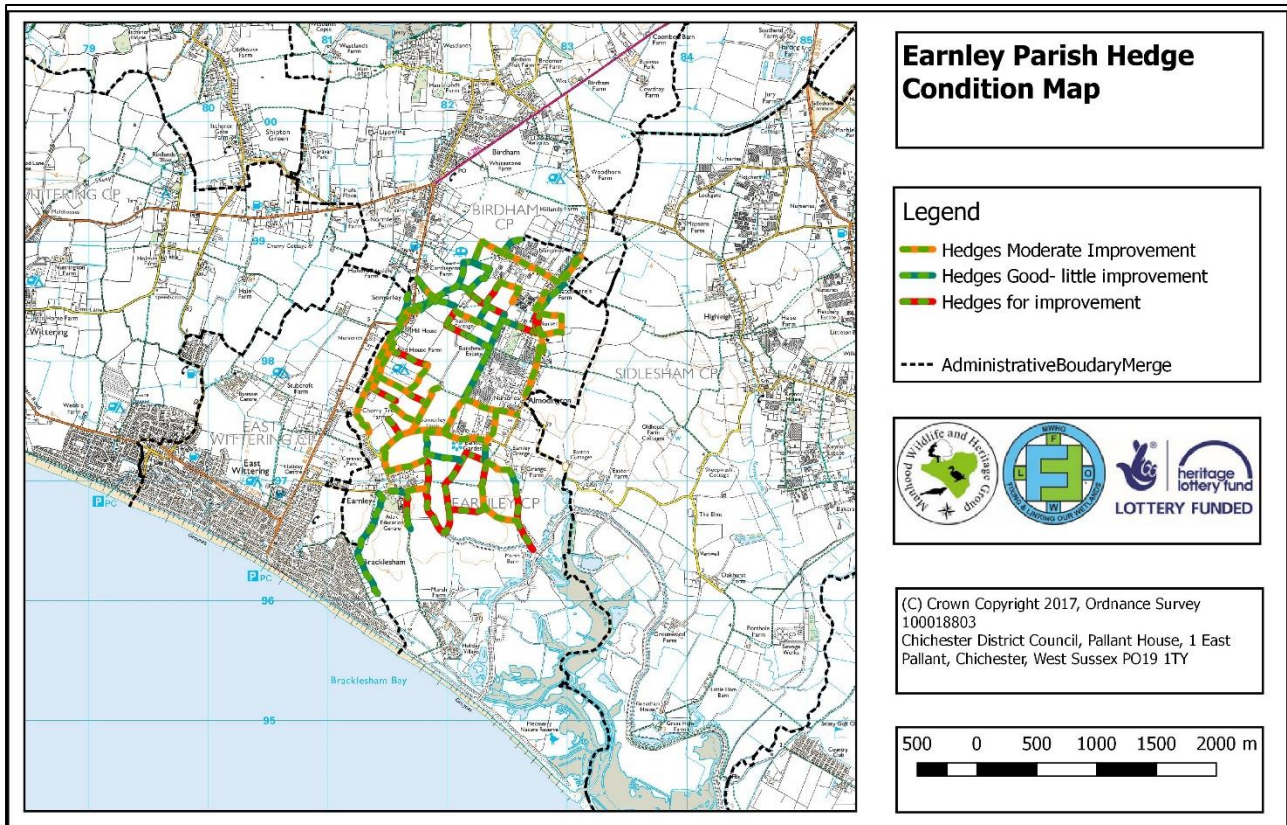
During the extensive hedgerow surveys, we carried out we found that Earnley has good coverage and any gaps or the potential to plant new hedges was discussed with the landowners. Managing hedges by laying them was also explored as this is a traditional technique for encouraging new growth in older hedges, thickening the base and providing better habitat for birds and invertebrates.

These issues were discussed with landowners, specifically:

- Sites for new hedges

- Hedges needing gaps filled
- Sites for hedge management – cutting back bramble on overhanging ditches and getting light on the ditch banks to get better vegetation diversity.
- Hedge management issues – alternatives to heavy flailing
- Hedge laying

Figure 20: Hedgerow improvement Opportunities in Earnley



Hedges are important for many species as a route along which to disperse and forage in safety. They also act as good windbreaks for farmers, protecting crop plants, help to prevent soil erosion and can act as barriers for crop diseases such as potato blight (pers comm. Monnington 2016). They are an important landscape feature on the MP where there are few woodlands and they are often overlooked and badly managed.

Comprehensive hedgerow advice and information can be sought from Hedgelinek:

<http://www.hedgelinek.org.uk/>

They provide information on planting hedges, hedge cutting, the hedge management cycle and hedges and their importance for a range of species.

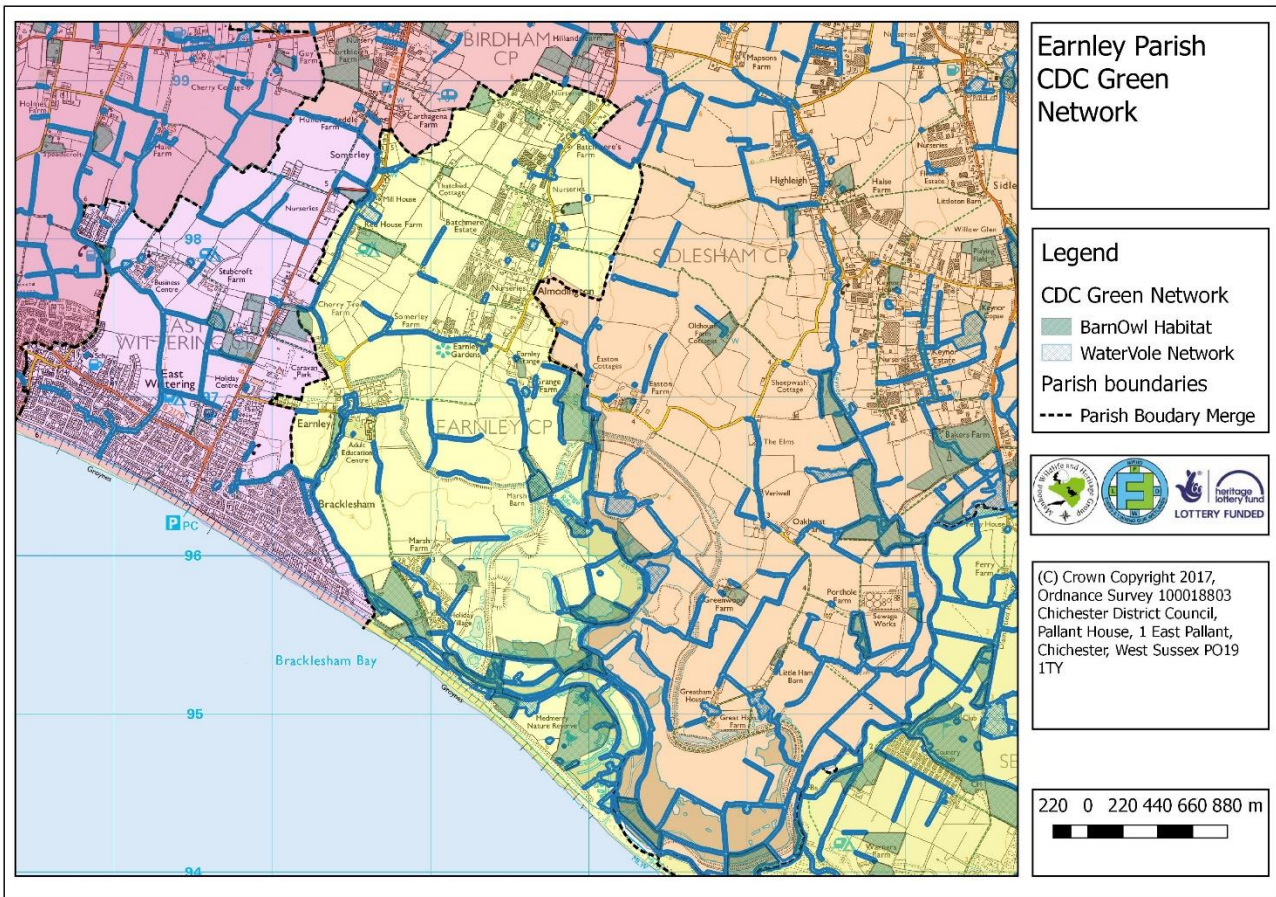
Hedges may not be beneficial for all species and this needs to be considered where appropriate – Lapwings (*Vanellus vanellus*) need large open areas with no hedges that potential predators could use as cover.

iv CDC Green network maps

The CDC Green network maps were created to look at three habitat types; wetland, hedgerow and rough grassland for barn owls. These were desk-based studies and had not been reviewed or previously checked.

As the FLOW team walked around the parish and examined most fields they were able to ground truth these maps and to check their accuracy at the time of surveying.

Figure 21: CDC Green network survey results for Earnley



The suitable waterways for water voles were noted and the meadows and margins for barn owls. The hedgerow condition map reflects the good hedgerows found for bat use.

Earnley has main rifes that contain water for much of the year and they are host to water vole populations at many locations. These rifes link the wider area to Medmerry, which had designed into its scheme, 6 km of specialised water vole habitat. There is now a strong population established and the rifes and ditches of Earnley allow water voles to disperse out across the area, boosting the genetic diversity of other water vole colonies.



Fixing and Linking Our Wetlands



Earnley Parish ditch condition assessment results and habitat improvement plan

10. Timescales

Work must be planned to fit in with the boundaries set by the wildlife and Countryside Act 1981, amended 2006, so that the birds breeding, and nesting season is avoided and also the water vole breeding season. This begins at the end of February and runs to the end of July, and during that time no removal of tree or hedgerow vegetation can take place, or ditches that may contain water voles (unless they are checked and voles absent or removed with a NE license).

Work may be best carried out between the end of July and the end of October, before the ground is too wet for heavy vehicles, and when the ditches are dry and do not have water voles in them – subject to checking. Where ditches have no records of water vole activity (can be checked via the Sussex Biodiversity records Centre <http://sxbrc.org.uk/>). Advice should be sought from the EA's Biodiversity Department (lead agency for water vole conservation) before carrying out any work on or around water vole habitat and Natural England (www.gov.uk/guidance/water-voles-protection-surveys-and-licences). Water voles can breed as late as October, dependant on the weather and therefore surveys must take place before any work is proposed. It may be that mitigation will be necessary.

The presence of ground nesting and wading birds would need to be considered during the winter months, but the work recommended in this report does not affect their habitat directly but may take place adjacent to farmland and indirectly disturb them.

11. Management priorities

Appendix iii is a plan of the proposed work with a detailed description of the actions required and an estimate of the funds required.

Ditch Management

Many long-term drainage and habitat issues can be solved with sympathetic monitoring and maintenance actions. Capital works can be paid for with grants or carried out by local councils but unless the work is followed up with regular management this money will have to be spent again 5 years or so down the line for the work to be repeated.

Ditches need to be managed carefully for drainage purposes and so that they function as good wetland for wildlife. This does not have to be mutually exclusive and by sympathetically cutting vegetation on the banks of ditches, not totally removing it, this provides better erosion resistance, which in the long term can affect the carrying capacity of ditches.

Where hedges are associated with a ditch it is common for the field side only to be managed and this allows the ditch to recover quickly and continue to offer wildlife habitat. Hedges next to ditches should still be gently cut back to prevent shading of the water but all debris should be removed, or it will block up the ditch, prevent water flow and potentially cause problems.

Refer to EA document '*delivering consistent standards for sustainable asset management*' Version 3 March 2012 for different cutting regimes that takes wildlife and water heights and conditions into consideration.

The debris from vegetation cuts around ditches, and hedge management, should be removed from site and not left in the ditch. This will only cause problems. Any silt removed from the ditch channel, where possible, should be left on the bank for 48 hours, to allow invertebrates to re-colonise the water, but should then be removed. Putting nitrogen rich sediment on the edge of the bank will cause some of the loose material to fall back in to the water if it rains, negating the work done, and it will produce a flush of nettles and reduce biodiversity along this edge. Where possible, time the work with ploughing of the field, and with an EA D1 exemption certificate, this nitrogen rich material can be spread across the field.

Ensure that no manure or silage is stored on ditch margins but kept away from waterways so that the nutrient rich runoff cannot pollute the water.

The wider the margin between the ditch and / or hedge, and the farmed land, the more wildlife potential the network will have, especially if it is not mowed more than twice a year and the debris removed. This could provide pollen rich and wild flower areas for invertebrates and birds to use.

12. Sources of future help

i Funding - grants

For the larger physical works to be carried out, landowners who have the equipment will be encouraged to do this work where possible. However, it may be that contractors or vehicles can be hired in to do the work but the issue of spoil removal will also need to be considered.

West Sussex County Council Operation Watershed fund - this has been supplied by central government for the use by local flood groups and organisations in the County for flood relief work and applications and information about the grants are available at <https://www.westsussex.gov.uk/leisure-recreation-and-community/supporting-local-communities/operation-watershed/>

Countryside Stewardship, managed by Natural England, can be considered in some cases with Mid-Tier and Capital Grants for wetland creation and improvement work:

Other grants that could be applied for.

Chichester District Council Communities Fund – looking at parishes south of Chichester and one of their priorities is to improve the wildlife value of the area – any wetland or hedgerow improvement could fall into this category. <http://www.chichester.gov.uk/article/24324/Funding-opportunities>

HLF – through the FLOW project – some monies maybe found to finance works but in-kind contributions would be sought from landowners and farmers to maximise the benefits.

There may also be **biodiversity grants** available from private companies Biffa, Viridor and Veolia, and plastic bag and other smaller grants that can be applied for from a range of supermarkets and retailers.

ii Labour – volunteer led work

MWHG use local volunteers across the MP to manage wetland and other habitat sites. Their knowledge and experience can be utilised to get working parties going and to lead improvement work.

Vegetation clearance work will need to be carried out on a rotational basis. The initial work, on overgrown ditches will be time and labour intensive but in future years this should be easier as only one years' worth of growth is tackled. A regular programme of works in each Parish, focussing on those particularly important ditches is the key, and making it a fun team building community experience that involved everyone will encourage continual participation.

The MWHG can organise and provide training in a range of areas and this can include learning more about the local fauna and flora, and also the practical aspects of habitat management. The training offered can include:

Educational: Plant identification
 Water vole surveying
 Ditch condition assessment surveying
 Hedgerow surveying
 Reptile surveying



Fixing and Linking Our Wetlands



Earnley Parish ditch condition assessment results and habitat improvement plan

Bat surveying
Bird surveying
Mink monitoring

Management: Health & Safety
First Aid
Hedge laying
Ditch management

A group of local volunteers carrying out management work in local ponds could be set up so that any improvement work is monitored and continued. Tools, training and resources could be provided by the MWHG.

The Trust for Conservation Volunteer (TCV) have a local group in Chichester who carry out physical improvement and conservation tasks <http://www.chichesterconservationvolunteers.org.uk/>

All these volunteer resources should be realised and encouraged to carry out important clearance work to expose ditches in winter months and remove smaller low tree branches shading out ditches. Making these working parties a regular event and having a social aspect to them will make them more sustainable. Not everyone is required to carry out physical work and volunteers can add value by providing refreshments, helping to do surveys, draw maps etc.

13. References

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- Chichester Harbour AONB Management Plan 2014 -2019 (Chichester Harbour Conservancy 2014)
- 'Options for the future of South West Internal Drainage District – business case' (TAW for West Sussex IDD Steering Group Dec 2013)
- 'Delivering benefits through evidence – quantifying the benefits of flood risk management actions and advice' (EA Report –SC090039/R Stage 3, March 2015)
- 'The Water Vole Conservation Handbook – 3rd edition', Rob Strachan, Tom Moorhouse, and Merryl Gelling, (WILDCRU, 2011)
- 'The Water Vole Mitigation Handbook' (the Mammal Society Mitigation Guidance Series), Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016) Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.
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- Downs & Harbours Clean Water Partnership. <http://www.cleanwaterpartnership.co.uk/>
- '*delivering consistent standards for sustainable asset management*' Environment Agency, Version 3, March 2012
- Notes of visit to Stroud Rural SuDS project – April 16 - Alastair Driver, National Biodiversity Manager Environment Agency

14. Appendices

i. Ditch Condition Assessment Form (MWHG)

Ditch Assessment – Score Sheet

Survey Information				
Location		Survey Ref.		Grid ref.
Recorder		Date		Rainfall
Water present	Y/N	Depth (m)		Flow

Attribute	Scoring criteria	Score		
Water availability	Dries out = 0; unsure = 1; always wet = 2	/2		
Ditch profile				
Ditch width	<0.5m = 0; 0.6m-1m = 1; 1.1m-2m = 2; 2.1m-4m = 3; >4m = 4	/4		
Ditch depth	<0.5m = 0; 0.6m-1m = 1; 1.1m-2m = 2; >2m = 3	/3		
Banks slope	neither bank slope between 30° and 60° = 0; one side only = 1; both sides = 2	/2		
Bank structure	Concrete = 0; gravel/sand/earth etc. = 1	/1		
Total		/10		
Environment				
B1* Buffer width	0m = 0; 0.1m – 1m = 1; 1.1m – 2m = 2; 2.1m – 4m = 3; > 4m = 4	/4		
B2 Buffer width		/4		
B1 Disturbance	High = 0; medium = 1; low = 2; none = 3	/3		
B2 Disturbance		/3		
B1 Bank erosion	Medium/high = 0; none/low = 1	/1		
B2 Bank erosion		/1		
Litter	Abundant = 0; present (1-2 items) = 1; absent = 2	/2		
Total		/18		
Bankside vegetation				
B1 Trees	/2	B2 Trees	/2	Absent = 0 Present = 1 Abundant/dominant = 2
B1 Bushes	/2	B2 Bushes	/2	
B1 Riparian forbs	/2	B2 Riparian forbs	/2	
B1 Sedges	/2	B2 Sedges	/2	
B1 Rushes	/2	B2 Rushes	/2	
B1 Reeds	/2	B2 Reeds	/2	
B1 Long grass	/2	B2 Long grass	/2	
Total		Total		
		/14		
Emergent vegetation				
Open water	<40% = 0; 41%-60% = 1; >60% = 2; (if dry enter NA)			/2
Channel vegetation	>61% = 0; 41%-60% = 1; 1-40% = 2; (if none enter NA)			/2
Total				/4
Management				
Rotation	Both sides managed together = 0; different timings/types = 1			/1
Shading	Watercourse >80% shaded by vegetation = 0; 40%-80% = 1; <40% = 2			/2
Sediment depth	>0.25m = 0; 0.1m-0.25m = 1; <0.1=2			/2
Cutting	Insensitive = 0; unknown/unsure = 1; sensitive = 2			/2
Invasive species	Any non-native invasive sp. = 0 (record info in sketch); none present = 1			/1
Total				/8
Overall score:				/70
<20 = red 21-40 = amber >40 = green				
Modifier	if score category does not reflect the ditch surveyed justify the new score category below			

*B1 = north or east bank of ditch, B2 = south or west bank of ditch

Additional ditch information			
Drainage issues	Previous flood events in vicinity		Yes / No
Connectivity	Number of adjoining ditches (if culverted more than 10m = no connection) Include ditches at either end of surveyed section		
Adjacent land use	B1	Arable Pasture Residential Garden Road Commercial Other	B2 Arable Pasture Residential Garden Road Commercial Other
Hedgerow present	B1	Yes / In-part / No	B2 Yes / In-part / No
Hedgerow survey	B1	Yes / No	B2 Yes / No

Pipes/culverts in ditch section		
Please record the location and condition of any pipes the ditch flows through, including at the start and end of the surveyed section.		
Ref. number (please label on map)	Condition description e.g. clear / blocked / collapsed / unknown	Approximate size
1		
2		
3		
4		
5		

Additional comments	
<p><i>e.g. any recent disturbances, blockages, information received from local people, concerns about invasive species, nature of any pollution, etc.</i></p> <p>Include a diagram if necessary</p>	

Annotate the survey map with the following information:

- Direction of flow where evident
- The location of any pipes/culverts with the reference number used on this form
- The location of any points of note e.g. sewage locations, blockages, invasive species, water vole signs etc.
- Mark any areas of flooding or very wet ground
- The location of any ash trees

Photo taken?

Yes / No

ii. Hedge Survey Form (short) Sussex Biodiversity Records Centre

Sussex Hedgerow

To help us, please **PRINT** and use black ink

Your details

First name _____ Last name _____
 Address _____

 Postcode _____ Tel no. _____

Please tick here if you do not want us to store your contact details on our database

Please tick here if you would be interested in taking part in a more detailed survey of this or other hedges.

Hedgerow details

OS map grid ref:

Parish/town _____ Site/Road name _____

Please attach a sketch map, or multimap showing the location of the hedgerow and send it to us with the form.

What kind of shrubs are in your hedgerow?

Look at leaf shapes shown. Please circle any you find. If unsure, please enclose leaf/twig. Please list other species here.

Does the hedgerow join with other hedgerows? Yes/No _____

What is the land used for on either side of the hedgerow?
eg garden/road, field/farmyard

How long is it? _____ How tall is it? _____ How wide is it? _____
 One adult stride is roughly a yard/metre. At ground level

Is the hedgerow dominated by any particular species?
If so, which one(s)?

Any other comments on the character of the hedgerow?

Which of these drawings does your hedgerow best resemble? Please tick box

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Drawings courtesy of RSPB

Please return this form before September 2003 to
 Hedgerows, Sussex Biodiversity Record Centre, FREEPOST, Woods Mill,
 Henfield, West Sussex, BN5 9SD.

Oak

Ash

Hazel

Holly

Yew

Field Maple

Beech

Elm

Hawthorn

Blackthorn

Wild Rose

Bramble

Elder

Climbers

Others

Drawings by Pete Edwards